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Progress in the Non-ferrous Foundry Industry

The president of the Association of Bronze and Brass Founders, Mr. George Hyslop, devoted the major part of his annual report to the members to his recent visit to Germany, where he went as leader of an investigation team. Amongst the many interesting phases upon which he reported, was the decision taken by the Nazis several years before the war to minimise the consumption of copper-base alloys, as they realised that under war conditions some of the essential metals would be in short supply. Thus so far as sand foundries are concerned, German industry has stagnated for nearly a decade. On the other hand they have made distinct technical progress in two major fields. The first is the virtual elimination of bronze gear wheels. In this case a slightly undersize steel component is placed centrally in a mould of greater diameter than the wheel, and the interspace is filled with liquid bronze. Then, after heat-treatment, the bronze is machined away except for a skin of about a millimetre in thickness. Except for certain specialised applications, the president was of opinion that on account of the excessive number of man hours expended on their production, bronze-coated steel gears had but little chance in this country of commercial success in the immediate future. The second development worthy of note was the centrifugal casting of cylinders. The largest seen were 40 ft. long, with an outside diameter of 5 ft., and weighing 16 tons. In other cases, steel bushes were centrifugally lined with copper alloys. Like other observers, Mr. Hyslop and his colleagues in the team were not impressed with the " Safety-first " measures as practised in Germany. In the ordinary foundries, the control of the properties of the sand used was virtually absent.

Referring to other activities of the Association it was pleasing to hear that after a year's experience of the standardised conditions of sale, it has been found that they need no modifications, as virtually no serious objections have been received. The Association has decided to publish a Bulletin, and, in fact, the first issue is off the press. It is being edited by Mr. Smithson of the Phosphor Bronze Company. Area meetings had regularly been held and the president made a special plea that members should use these gatherings for fostering friendships between their technical staffs, so that mutual help could quickly be given when problems arose. Mr. Holligan, the chairman of the technical committee, also dealt with the answering of technical queries. In the future even he as chairman would not know the origin of any query submitted. Where a visit to the works itself was indicated the origin would be known, and then only to the official investigator, Mr. Frank Hudson. The Association, though still young, has an excellent record of achievement and under its present enlightened leadership will do much to enhance the welfare of this important section of the foundry industry. The report on the German Non-ferrous (Copper-base) Foundry Industry ranks amongst the best of a large number that have been inspected, and we shall comment upon this report in some detail when it is released for publication.

BAD NEWS

We hear from many reliable sources that the Ministry of Education has shelved the question of the reopening of the British Foundry School. The reason, according to our information, is that the creation in the University of Birmingham of a new department of Economic Metallurgy provides the necessary facilities! Organised activities within the industry are already preparing protests, as they rightly believe that these two excellent schemes are complementary and not competitive.

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GERMAN LIGHT ALLOY FOUNDRY INDUSTRY

Mr. F. McKenning, Mr. L. R. Carr, and Mr. F. T. Davis were members of a team sent over to Germany to advise evacuation of laboratory and foundry plant and equipment considered useful for technical development and items required for improvement of production capacity in the United Kingdom, and to report points of special interest connected with the light alloy foundry industry as practised by German founders.

The Report they issued to the British Intelligence objectives sub-Committee, states that, generally, there was no evidence to prove that the design or efficiency of foundry plant and equipment had any outstanding advantages over that installed in modern English foundries, but laboratory equipment installed for metallurgical control and X-ray examination was of a high order and of a variety not normally possessed by founders in this country.

It was evident that production during the war had been highly organised and restricted to certain types of castings in individual foundries, which to a large extent accounted for the high production rate attained. It was felt that investigation of the German light alloy foundry industry, particularly in respect of sand castings, was not adequately covered.

We have abstracted two notes of general interest:—

CO was actually preferred to Mn, but the latter had had to be used for some time owing to the supply position. Shortage of Si had caused the range of Si content to be reduced from 10-13 per cent. to 9.0-11.5 per cent. They had also used a high purity aluminium alloy with 5 per cent. Mg and small quantities of Ti and Be, the object of the Be being to inhibit sand attack. This alloy had been used for cylinder heads. The only heat-treatment given to it was three hours at 300 deg. C. for the purpose of stress relieving. It was stated that the ultimate tensile strength of this alloy at 300 deg. C. was from 6.5 to 8.0 tons per sq. in. with an elongation of from 10-20 per cent.

When asked whether they had used a 10 per cent. Mg aluminium alloy of the DTD.300 type, they replied that this alloy was not used because of its tendency to stress corrosion. In support of this they quoted tests made by Heinkel's on a Lancaster undercarriage support beam, which fractured after 1½ days under stress in a brine atmosphere. The exact conditions of this test were not discovered, but a photomicrograph of a section showed extensive intercrystalline cavitation running in from the surface.

Modification of Silumin (Alpax)

At one foundry it was stated by the technical direction that the use of metallic sodium as a modifying agent was usually associated with porosity in the casting. They had attempted to overcome this by using sodium, which had been cast into aluminium tubes and immediately sealed off, but although this gave an improvement it did not cure the trouble. They were

(*Continued at foot of next column.*)

IRON AND STEEL NATIONALISATION

In a statement made by Mr. Ellis Hunter, chairman of the Council of the British Iron and Steel Federation, and unanimously approved by the Council, the Federation's opposition to the "nationalisation of any section of the group of industries commonly known as the iron and steel industry," is reaffirmed.

Mr. Hunter said that the industry was not opposed to public supervision. On the contrary, it had willingly operated under public supervision for several years before the war. The Government motion, due for debate next week, referred to the nationalisation of sections of the iron and steel industry "with a view to its efficient organisation in the public interest." This efficiency was also the purpose of the industry, with the firm belief that it could only be achieved quickly and effectively under the industry's plan and policy, which includes public supervision. Nationalisation of sections of the industry would tear the heart out of the most efficient organisations and destroy the best hope of raising the general standard of efficiency in the industry.

TECHNICAL CONFERENCE IN BELGIUM

At the invitation of the Conseil Professionnel de l'Industrie des Fabrications Metalliques, Mr. A. W. Berry, M.I.Mech.E., M.I.E.E., director of the British Engineers' Association, attended the 60th annual Manifestation Scientifique in Brussels last week, promoted by the Société Royale Belge des Ingenieurs et des Industriels. This was the first large-scale meeting held since the cessation of hostilities, and world-wide technical progress of the war years was reviewed. From the U.S.A., Professor Henne read a Paper on wartime progress in industrial organic chemistry; French, Swiss, Swedish, Dutch and Belgian scientists and engineers dealt with facets of progress in their respective countries, and among contributors from the U.K. were Sir Edward Appleton, Dr. Desch, Mr. C. W. Marshall of the Central Electricity Board, and Mr. R. B. Shepherd.

GERMAN LIGHT ALLOY FOUNDRY INDUSTRY

(*Continued from previous column.*)

convinced that for high-class castings where freedom from porosity was essential salt modification was the best method. For this purpose they used a mixture of 4 per cent. KCl, 64 per cent. NaF, and 32 per cent. NaCl. The method of modification is to cover the metal with about 1 per cent. of this salt at 750 to 800 deg. C for between 20 and 30 mins. The modification is then effective for about 10 mins.

Moulding Practice

Indications of extensive use of chills were observed in connection with silumin casting technique. All chills were heavily serated on the surface in contact with molten metal, presumably to prevent blowhole defects, and contained drilled vent holes ¼ in. dia. spaced 1 to 1½ in. apart over the whole area of the chill.

MASS PRODUCTION OF TANK WHEELS IN "BLACK HEART" MALLEABLE*

By A. B. BILL and J. PEERS

INTRODUCTION

This Paper describes the layout and operation of a plant specifically laid out to produce large quantities of a particular casting in high-grade black heart malleable iron, and annotates at the same time some of the problems which arose, how these were tackled and overcome.

Quantity production of these castings was required as soon as possible without interfering with production in the company's existing foundries, already burdened to capacity with armament commitments. In view of the short time available, it was decided at the outset that metal should be melted in the air furnace, proved by long experience to produce metal satisfactorily to the narrow limits of temperature and analysis required. This batch melting was the deciding factor in the general layout of the plant.

Approximately 3,000 castings per week were required, to be completely processed, and to this end a self-contained unit was designed by the directors and executives

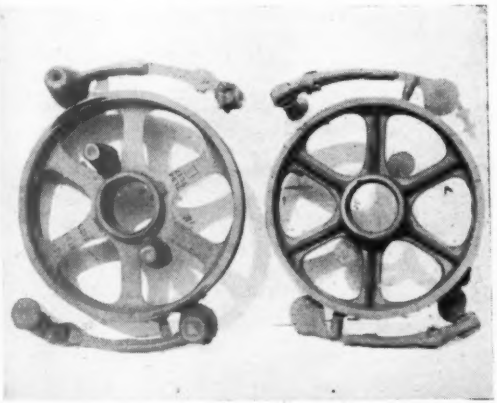

FIG. 1.—BOGIE WHEEL T.L.17 (ONE OF THE CENTRE BOSS FEEDERS WAS EVENTUALLY DISCARDED).

of Ley's Malleable Castings Company, Limited, of Derby, and located at their Lincoln works. The casting itself (Fig. 1) may be briefly described as a 6-spoked wheel with a heavy rim of ¾-in. maximum section, and a relatively light centre boss. The rim is machined on three outside faces, the centre boss is faced top and bottom and machined inside from both ends down to the ball-retaining rings. The outside diameter of the rim, as cast, is 17 in. and the total depth of the boss is 5 in. The casting weight is 58 lb.

*Paper presented before the East Midlands branch of the Institute of British Foundrymen, at Derby.

General Layout

The general layout (illustrated in Fig. 2) of the plant is of particular interest, since it is one of the very few continuous systems operating in black heart malleable in this country, and also since it involves marrying a continuous moulding system with batch melting. Moulds for cope and drag are produced on three pairs of identical Pneulec Hermann jolt rollover machines, 20-in. by 36-in. tables, and gravity roller conveyors provided to carry away half-moulds to the closing stations (Fig. 3). In order to carry bottom halves to a suitable position for closing, and complete moulds to casting conveyors, a transverse trolley with automatic stops is used for each pair of machines.

Seven casting conveyors, each accommodating 25 moulds, are provided for each moulding bay, the total capacity being 525 moulds. In order to give a certain amount of gravitational assistance to moulds travelling along the conveyors, these are sloped 7 deg., the floor being sloped the same amount so as to preserve uniform height for pouring.

Moulds are poured at three periods during the day, each by two ladle men, metal being transported to pouring stations at the end of each conveyor by means of two-wheeled bogies of 5-cwt. capacity. Metal is melted in a 20-ton air furnace, melting two heats a day, and for the middle casting period further metal is drawn from a similar unit in an adjacent foundry.

Sand-handling Arrangement

After a short cooling period, mould tops are lifted and sand knocked out over the gridded knock-out conveyor, castings being lifted out and bottom parts also knocked out. Box parts are returned to moulding stations, again by gravity conveyor; four of these returns are installed and machines so placed as to share the conveyors between them. Spent sand from the knock-out passes through the grid on to a 24-in. flat-belt conveyor running at 100 ft. per min. (Fig. 4), which feeds into a flat cross-belt inclined at 10 deg., which in turn feeds a further cross-belt running parallel with the knockout belt. This is inclined at 30 deg. and feeds into a rotary screen. The screen (Fig. 5) rejects tailings, solid lumps of core sand and larger pieces of sprue, and clean sand passes from the screen under a magnetic separator to remove fine tramp iron and thence by means of a bucket elevator to a 20-ton capacity storage hopper. The feed to this hopper has hand adjustable ploughs to regulate the flow of sand and to distribute it evenly according to mill requirements.

Sand is fed from the bottom of the storage tank into an electrically-operated skip loader (Fig. 6) with top

Mass Production of Tank Wheels

and bottom trips which hoists 5-cwt. charges into the sand mill. The mill is a 5-cwt. capacity raised roller, intensive type batch mixer which discharges through an hydraulically-operated door to a comb-and-pin type disintegrator and thence to the distribution belt. Coal dust, new sand and water additions are made manually, the former into the skip and the latter into the mill.

FIG. 2.—MOULDING BAYS SHOWING MACHINES AND SAND HOPPERS.

Milled sand is ploughed off the distribution belt into 35-cwt. capacity hoppers, one for each machine. Due to the upward and forward rollover of the machines, it was not possible to locate these hoppers directly over the moulding tables, and sand is therefore fed through chop gates at the bottom of the hoppers down inclined shutes, the shutes swinging backwards and upwards clear of the operators after filling the moulding boxes (Fig. 7).

Immediately after knocking out, runners and feeders are knocked off castings and sprue placed in heaps along the front of the knockout grid ready for collection and weighing as part of charges for succeeding heats. Castings, with the exception of obvious wasters such as mis-runs, are wheeled away in hand-barrows to a continuous, rotary-table, impelled-shot cleaning machine (Fig. 8) with a 10-ft. dia. table. This machine cleans castings very efficiently, particularly if care be taken to keep the system as clear of sand as possible by insisting that all core sand is removed from the centre boss before placing on the machine. After cleaning, each casting is trimmed of flash, if any, visually inspected for surface defects, cracks, or hot tears, the position of the core is checked by means of a simple "go" and "not go" gauge, and castings are then passed on for annealing.

Annealing Ovens

A battery of five brick-built ovens (Fig. 9) fired by pulverised coal is used for annealing, the coal being drawn from a ring main taking its supply from the storage hopper attached to the same "Attritor" which provides fuel for the melting furnaces. Castings are packed into 24-in. square open-ended pots, each pot being 12 in. deep, pots being stacked five high. A neutral packing material is used and all the edges of the pots are carefully luted with a mixture of sand and ganister to provide a seal. Each stack is built up on a cast-iron stool specially designed for the use of a charging truck which lifts these and places them in the ovens. The temperature of each oven is controlled by two thermocouples indicating on millivoltmeters and recording on potentiometers. After completion of the annealing cycle, pots are withdrawn

FIG. 3.—GENERAL VIEW OF MOULD CONVEYORS.

from the ovens, tipped over, castings are removed and packing material and pans returned for further use. Castings are passed on to three double-ended high-speed grinding machines with 30-in. by 12-in. by 2½-in. stones, running at 9,000 peripheral ft. per min. (Fig. 10).

Grinding and Straightening

Runners and feeder mouths are removed and any incidental point. Flash, caused by ragged edges or improperly closed moulds, is trimmed off. Further fettling is only necessary in about 1 per cent. of the total wheels produced, and castings are then ready for straightening. Straightening is necessary to correct any settling or distortion which may have occurred during annealing, and is effected by heating castings to a temperature just below the critical point, *i.e.*, around 650 deg. C. and squeezing each casting hydraulically between specially designed dies. In order to make this a continuous process, castings are passed through a continuous furnace (Fig. 11), consisting of a lateral plate conveyor passing through a brick-built chamber. This is fired by a simple pulverised-coal burner throwing a long flame from end to end. The furnace is equipped with a pyrometer to ensure that the castings are not overheated.

Continuous loading is effected through an opening in the side of the oven just past the hearth, castings being lifted and placed flat on the loading table and then pushed into position on the conveyor by means of a stirrup-shaped bar. They are gradually heated as they travel towards the discharge end of the furnace and pass through the vertical swing doors at their maximum temperature, unloading on to a flanged table between the furnace and the hydraulic press. They are lifted from the table to the press by means of hand tongues and removed by the same means, stacked at the back of the oven and allowed to cool slowly down to normal temperature.

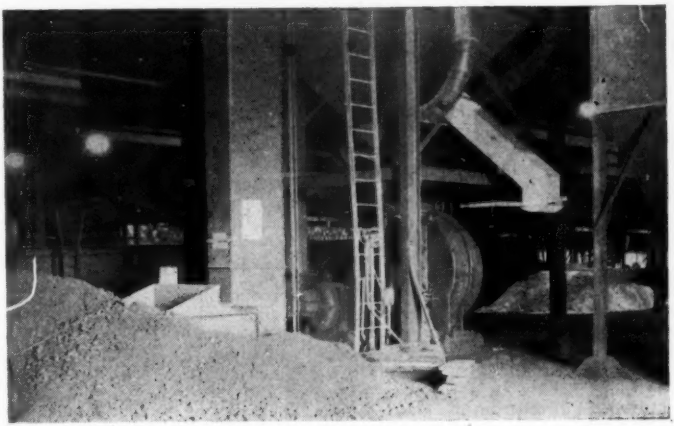

FIG. 5.—HIGH-SPEED ATTRITOR UNIT.

FIG. 4.—GENERAL VIEW OF INCLINED BELT AND ROTARY SCREEN.

The dies are so designed as to correct distortion in the outside flange and to correct any variation in the relation between centre boss and outside flange. The temperature of the wheels to be pressed must be controlled to within fairly close limits. A high temperature exceeding the critical point causes re-solution of the carbon and resultant hardness. A low temperature, giving smaller thermal expansion, causes binding on the dies and this interrupts the flow of operations. It was found to be very difficult to maintain accurate temperature control for some little time until the operatives who were entirely new to foundry work, and indeed to industrial work of any kind, had gained some experience of the furnaces.

F

Mass Production of Tank Wheels

Control is effected in a number of ways; pulverised coal and secondary air feed affect both the temperature and length of flame; the flue damper, situated close to the discharge, has some effect on length, and of course density. The conveyor has a multispeed clutch giving a rate of travel from 0.393 to 2.35 ft. per min., the rate of travel obviously affecting temperature considerably. The method of loading wheels on to the conveyor, too, is important. Theoretically, of course, maximum efficiency would be obtained by standing castings upright on the conveyor. This is not possible, however, since there is a tendency to sideways motion if this is done, bringing castings into contact with the sides of the furnace and scoring the brickwork badly. Apart from this, it is necessary, due to the rapid drop in temperature, that castings should be discharged singly, or at the most in twos. After some experiment it was finally established that wheels should be rested one upon the other at an angle of around 45 deg.; this would appear to give optimum results, the production from this plant with three operators, one loading and two working on the press, being as high as 130 wheels per hr.

After straightening, the finished wheels are recleaned. The same plant is used for this final cleaning as for hard wheels direct from the knock-out and, in order to preclude the possibility of hard and annealed castings becoming mixed, all soft cleaning is done at night, castings being taken to the cleaning table from the straightening press and returned, cleaned for soft inspection. Here castings are again inspected, chiefly for cracks or hot tears which heat-treatment and pressing may have opened, although it will be seen later that wheels produced in this foundry were largely free from such defects.

Having described briefly the layout of the plant and sequence of operations, it is desired to return to the moulding process and to illustrate more fully how production was developed from scratch, bearing in mind that over 90 per cent. of the labour employed was Irish, with no previous experience of foundry work.

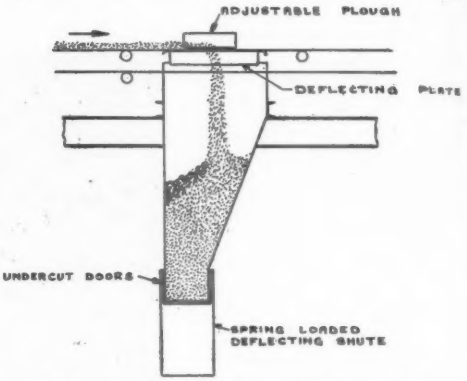

FIG. 7.—SAND HOPPER UNDER DISTRIBUTION BELT CONVEYOR.

Planning of Moulding System

It cannot be too strongly emphasised that the initial care and forethought applied during the planning of the moulding section contributed largely to the success of the plant as a whole. Delivery schedules were at all times met, and no major foundry problem interfered with full-scale production. Even when a change of design brought about by the need to economise in rubber tyring, complicated the problem of running and feeding, and upset the balance of the casting with regard to cooling, so complete and thorough were the trials (largely carried out in the company's Derby foundries), that the changeover was effected without any pause in production.

Particular attention was given to the mould. The cast-iron moulding boxes used are specifically designed for the casting, being interchangeable and having bars so designed as to eliminate lifters for top parts; neither are bottom boards needed to traverse the gravity conveyors. Lugs, cast integral with the main

FIG. 6.—STORAGE TANK AND SAND MILL.

box part, are drilled $\frac{7}{16}$-in. dia. to receive round pattern pins attached to the pattern plates for the purpose of location. Final register of the two halves is obtained by means of master assembling pins, a tolerance of $\frac{10}{1000}$ in. being allowed on the pattern pins and $\frac{5}{1000}$ in. on the assembly pins. Clamping is effected by the use of a V-shaped malleable-iron cramp tapped into position over top- and bottom-part lugs. The method is simple, speedy and positive, and only isolated cases of runouts due to cramp misplacement occurred.

Sand Control

It was decided at the outset to use a naturally bonded sand in the system, largely because of the high hot strength of synthetic mixtures and the danger of hot tears with the low-carbon iron used, together with the design of the casting, which particularly lends itself to this type of defect. A sand of medium grain size with a high clay content was found, after some experimenting, to be most suitable, and 5 per cent. additions of this sand, together with 5 per cent. coal dust, maintains a workable mixture. Average physical properties of the mixture are:—Moisture, 6.5 to 7.5 per cent.; permeability, Nos. 35-40 A.F.A.; and green compression, up to 60 lb. per sq. in. from test samples taken at the mill.

It will be appreciated that minimum additions of new sand are desirable, since once the system has been loaded, for all additions made there must be an equal amount of discard. Moisture content may be considered high, but moisture tests taken at the hopper mouth above the moulding machines show a decrease of up to 1 per cent. Drying-out varies, of course, with prevailing weather conditions and with the temperature of the sand in circulation. During peak moulding conditions, sand temperature at the mill rises as high as 30 deg. C., due to using sand from recently cast boxes. Permeability figures were not as high as was at first thought to be desirable, but rejects due to blowholes, scabs or cuts were non-existent, and it would appear that the uniformity of the mixture allows of lower figures for permeability than would be necessary if any great variation in strength, grain size or moisture content were allowed. A green strength of 6 lb. per sq. in. was maintained to reduce to a minimum waste due to broken moulds; but from the Authors' observations, it would appear that plasticity or tensile strength is the quality which helps the mould to withstand rough usage; for example, the shocks sustained when travelling down roller conveyors. Gardom, in his Paper "Mass Production of a Manganese Steel Casting," recognises this quality and set up routine tests to control it.

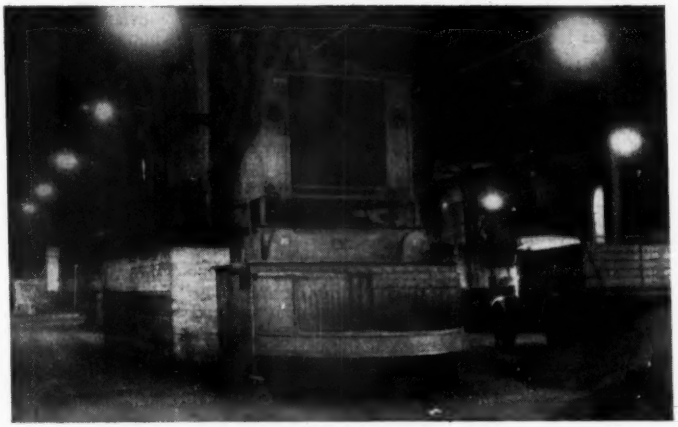

FIG. 8.—IMPELLED SHOT-CLEANING MACHINE.

FIG. 9.—FRONT OF ANNEALING OVENS.

Mass Production of Tank Wheels

In view of the hourly requirements of sand, milling times are cut down to an absolute minimum; taking the average requirements as being 8½ tons of sand per hr., the maximum permissible milling time with 5-cwt. batches is less than 2 min. Obviously, therefore, it is necessary to use a milled sand as a basis of new sand additions, since a lumpy sand would not be sufficiently broken down in the time available. The sand available which answered most nearly to these requirements was a milled Pickering yellow sand, 5 to 6 per cent. additions of which maintained the required green strength and reducing the discard to a minimum. Eventually the amount of discard was almost balanced by sand adhering to castings after knocking out, thus eliminating difficulties in the disposal of spent sand. This mixture was found to be entirely satisfactory, particularly as regards the reduction in broken moulds, *i.e.*, copes which broke on rolling over or moulds which collapsed after closing. The 5 per cent. coal-dust additions are kept constant and the figure is sufficient to give a blue tinge on castings knocked out, and to give a sufficiently refractory finish to prevent undue burning on of sand, thus assisting in cleaning.

It is of interest to note that a supply of extra fine coal dust became available at one period and coincided with a particularly bad batch of broken moulds. A 30 per cent. reduction in total coal-dust addition during this period reduced the scrap, but gave very dirty castings which were very difficult to clean. Routine tests showed no decrease in compression strength during this period, but from the "feel" of the sand a certain amount of plasticity seems to have been lost due to the finer coal dust.

Treatment of Mixed Sand

Complete distintegration of the mixed sand is essential where sand is delivered direct from hoppers into a moulding box. It is necessary that sand should pack down over the pattern, forming a true contour without necessity for riddling. It was found that as the pegs of the disintegrator became worn, sand tended to ball up and pass along the distribution belt to the hopper in small hard lumps. This gave rise to serious concern, since, apart from giving a rough surface to castings, the shape of the hoppers and positions of ploughs combined to deposit all the rough sand on one side of the hopper and relatively smooth sand on the other. Upon opening the hopper to deliver sand to the machine, one side of the moulding box was filled with smooth texture sand and the other with balls of rougher sand. The two did not mix well during jolting and gave rise to a number of broken moulds. The obvious remedy was to ensure that disintegrator pins were replaced regularly, but this was not easy, particularly in wartime, and in any case wear was gradual. The only successful method of obviating the trouble was to endeavour to keep sand hoppers at all times reasonably full in order to prevent segregation of the lumps. Where really smooth castings are desired, it would appear, from the Authors' experience, that distintegration of facing sand at any rate, is essential.

It was intended originally to employ female labour to operate the moulding machines and, indeed, female labour was tried as a possibility in view of the acute man-power shortage at the time of starting up the plant. It soon became apparent, however, that the fatigue involved in lifting heavy cast-iron moulding boxes and the necessity for flat ramming (there being no mechanical squeeze on the Pneulec machines installed) could not secure reasonable production. Eventually, therefore, the three pairs of machines were staffed by male operatives, two men to each machine, each pair of machines having a moulder and assistant for finishing, closing and clamping, with a female to blow out bottom parts and set the grids and cores.

The two half-moulds are carried away from the drawtables on parallel gravity conveyors, the bottom half is cored, and blown clean by a low-pressure air supply, while the top half is set up at the end of the conveyor on a trestle, blown clean and a daily identification stamp put on by hand. The bottom is transferred to a transverse bogie and brought up to the top half for closing by hand. This operation is not unduly fatiguing, the weight of a rammed top half being around 1¼ cwts.; assembly pins are inserted in top-half lugs, two rubber-handled carrying pins inserted each side, the box part

FIG. 10.—HIGH-SPEED GRINDING MACHINES.

lifted over to bottom half and closed speedily and cleanly.

The original layout of the moulding section included a fixed swivelling jib crane to pick up top parts and transfer them to a suitable position for closing, a hand-operated pulley block being incorporated to raise and lower the box part. This was certainly effective, but, as production from the machines speeded up, the closing operation using the cranes became such a serious bottleneck that the hand-closing method was devised and the cranes were not used.

Design of Pouring Basin.

In order to reduce finishing and closing to a minimum, a pouring basin was devised as follows:—The tapered peg A (Fig. 12) forms the down gate and is fixed to the top half-pattern plate, the base of this, where it is screwed to the pattern plate, being radiused as illustrated. This gives a smooth finish and prevents the formation of loose edges which are likely to occur if no radius is allowed. The cone-shaped head B forms the pouring basin and is loosely dowelled to the pin; this is given a couple of quick turns after the mould has been rammed and is then withdrawn, the tapered peg being, of course, withdrawn with the pattern. Uniform pouring basins and downrights are thus obtained without the necessity to cut these at the closing station, and only such loose sand as may be occasioned by the dowelled joint, and very little of this, is left to be blown out. Further, the fact that the pouring basin is smooth, precludes the possibility of loose sand inclusions being swept out of it and into the mould.

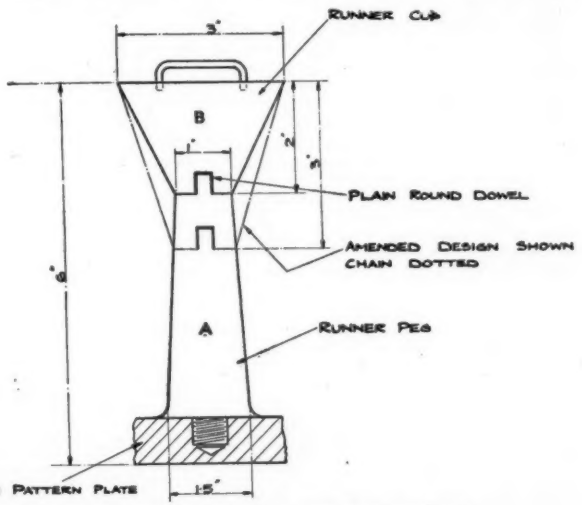

FIG. 12.—DETAILS OF RUNNER AND POURING BASIN.

Jolting and ramming of the moulds is controlled to give an average mould-face hardness figure of around 80 to 85 A.F.A.; this ensures a casting free from local swelling and of consistent weight. The maintenance of jolt tables, in the Authors' opinion, is of major importance, a really flat jolting action being essential to the production of good moulds which are true to pattern. It should be borne in mind, too, that completely unskilled labour was used to start these machines, and that all possible assistance was necessary to encourage them to produce. It has been a source of surprise to the Authors how easily operators are discouraged if things do not go according to plan.

(To be continued.)

FIG. 11.—REHEATING FURNACE AND STRAIGHTENING PRESSES.

A CONCERN in Chicago makes cores for sale to the local foundries.

LABOUR WORRIES UNDER E.W.O.

By A. BEE

Present labour conditions make the job of the foreman or supervisor anything but a sinecure. Several factors combine to make the control of labour far more difficult than in the days preceding the late war. Chief among the factors is the Essential Work Orders. In order to get the best from his men, a foreman must be, not so much the *keen* disciplinarian as formerly, as a *tactful* disciplinarian. This certainly does not mean "softness" or any lack of firmness. To be a success, the foreman must gain the confidence of those in whom he is in charge, and there are many ways of achieving this. For instance, encouraging suggestions are not always a waste of time. A discussion of this type often affords opportunity of psychological study, the results of which may be a considerable help in handling at least one man.

Decline in Skill

Individual idiosyncracies should be studied and corrected. For instance, it may be found that one moulder's particular trait is carelessness in sealing vents; another may persist in using unsuitable runner-bushes, etc. This type of error is far more prevalent under present conditions than was the case in more normal times, but the foreman can, by being vigilant and firm, gain a healthy respect. One or two cases can serve as useful examples. A moulder engaged on a repetitive class of work was particularly prone to "run-outs." The resultant waster castings were almost invariably returned on the scrap sheet as "short-run" or scrapped on account of slag-inclusions. As this meant no loss of bonus to the moulder, little real effort was made by him to improve. A new foreman quickly realised the position and got down to "brass-tacks." The man was shown the cause of the trouble, *viz.*, bad sealing of joints and ill-fitting boxes caused by previous "run-outs." Having cured the trouble, the man was told that any recurrence would be booked against him, and, needless to say, that form of scrap has now almost entirely disappeared.

On another occasion, a very good moulder was having much trouble with a complicated, jacketed pump cylinder. Having already made four waster castings, the man was losing both confidence and temper, when the Author was given a free hand to attempt a fifth. The coremaking was subjected to very strict supervision, as also, was the coring-up operation. Full explanation was given to the men for any alteration to previous practice. Happily, the job cast very quietly and proved to be a good casting. A second was made (it was a two-off order), with equally good results. Apart from the execution of the order, much good accrued from this episode, for the foreman had undoubtedly gained the confidence of the best moulder and coremaker as well as that of the foreman coremaker.

Unskilled Labour Problems

The control of unskilled labour presents rather a different problem. From the Author's foundry, many labourers had been transferred to other departments during the war, where they had enjoyed far greater wage-earning opportunities. In some cases these men were able to "earn" up to five times as much as their former colleagues. In consequence, the residual foundry labour felt a sense of grievance, and this manifested itself in a great reluctance to work. The fact that the Director of Labour saw fit to substitute some of the transferred men with ex-newspaper vendors and former workhouse habitués, did much to aggravate the situation, but nothing to alleviate the worries of the foreman. In most cases the men's sole objective was to get as much as possible for doing as little as possible, and whenever pressure of work allowed, overtime was only given to the best men.

Overtime

Overtime, nearly always an uneconomic policy, has been a necessity during the last six years, and this has in many ways affected the discipline of the shops. At first most of the lower-paid men were keen to participate in any overtime offered as a means of augmenting their wages. When, as often happened, certain of these men were required to work a large amount of overtime, thereby perhaps doubling their normal earnings, tradesmen would begin to complain. The fact that a dearth of labour made these conditions imperative, was conveniently ignored, and in extreme cases, slow-timing was tried. Moulders would seek all kinds of excuses to be paid waiting time. The "Bevin Act" suitably covered such contingencies as these, inasmuch as a man could not refuse to obey a reasonable order, provided he received his normal rate. Hence, a foreman could demand that any enforced waiting time should be worked on other jobs, however menial. Firmness on the part of the foreman in this respect has greatly reduced claims for waiting time, as the men now look further ahead. For instance, if they can see the likelihood of a crane being engaged for long periods on a job, they will endeavour to plan their own lifts accordingly.

Absenteeism

The foregoing are but minor headaches compared with those occasioned by flagrant absenteeism. When the foreman takes to interviewing returning absentees individually each morning, it is surprising what ingenious excuses are often forthcoming. He would, indeed, be without sense of humour if he did not appreciate the joke of an habitual tippler confessing he "fell downstairs after only having four pints." War-weariness may or may not account for so many "sleeping-in" when the local football team is playing at home. Some of the bad time-keeping is made in fond hope that the delinquent will ultimately be "released." While it may be argued that an unwilling worker is no asset, an unsympathetic Manpower Board usually regards an employer's acquiescence in these cases as indicating a surplus of labour and refuses to substitute. It therefore devolves upon the foreman to make the best of a bad job, when the management declines to take action.

(*Continued on page* 91.)

IS THE PATTERN SHOP AN ASSET OR A LIABILITY?*

Some observations by a pattern-maker

By H. PADLEY

The general term used in the foundry world in reference to the pattern shop is that it is a "necessary evil." Necessary, perhaps, but a well-equipped, efficiently and economically run pattern shop can prove an asset in cutting down the production costs in the foundry, for which the pattern shop receives no credit.

It can be said of the pattern shop that it is the toolroom of the foundry, and on the efficiency of its products rests the production of the foundry, especially in a mechanised plant where the pattern must be mechanically efficient and work to as fine a tolerance as the machine on which the moulding operation is performed. Great help in this direction is the use of metal patterns, metallised wood patterns, or wood patterns with metal wearing strips. Where the design of a pattern makes the making of a metal pattern a simple and economical one, that is, a straightforward operation to give the pattern the desired finish, then most certainly make metal patterns, if the size of the order warrants it, and also for the sake of accuracy

That raises the point of what is accuracy. Accuracy in pattern-making is the "*Ideal*," but the accuracy achieved in the making of a pattern is governed by the design of the pattern, the nature of the material from which it is produced, the tools by which it is produced, and the method by which it is constructed.

An irregular-shaped pattern cast in metal from a master-pattern may prove difficult in its ability to be given a smooth skin finish, desired for the moulding operation; also any discrepancies, due to contraction or moulding of the metal pattern, may be difficult to remove by orthodox methods, and in some cases a wood pattern, or even two, with metal inserts at the most vulnerable points, may prove the better proposition, taking into consideration the degree of accuracy desired of the resultant casting.

Importance of Accuracy

Great strides have been made in the production of castings to suit the requirements and specifications demanded by the engineer. The engineer has likewise had demands made in respect of large numbers of finished products, conforming to a high degree of accuracy in dimensions, shape and weight. To this end, he has developed the use of pigs and specialised machine tools. Thus, he now demands castings with a high degree of uniformity in dimensions to fit his jigs, with a minimum of allowance for machining.

Accuracy of the casting depends largely on the accuracy of the pattern, and, in a matter of production, it is for the pattern shop to produce the best pattern possible, which cannot be done by producing the cheapest pattern.

Equipment and Methods

The pattern shop has developed very little either in equipment or methods of producing patterns, chiefly because the cost of up-to-date plant is regarded as an expense which would increase overheads, and not give adequate return to warrant its installation, yet to produce better patterns without increasing their cost it is necessary to have adequate equipment. The cost of patterns should be studied in the light of whether it is more economic to spend a little more on the pattern and less in the foundry, or *vice versa*. This depends largely on the size of the order.

In some instances it is undoubtedly preferable to produce the cheapest pattern possible as in the case of replacement of castings for breakdown jobs, where only the fundamentals of the pattern need be made, leaving the moulder to finish the job, and in the case of one-off jobs, if it truly is a case of one off. This is a matter which needs deciding before the pattern is made and when the casting is fully completed and applied. it is suggested that, if at all possible, the pattern should be dismantled and all available timber utilised in the making of other patterns, thus creating a saving in timber and storage space.

Storage of Patterns

The storing of patterns can be a difficult problem, even though one discards patterns that may be required again some time during the next twenty years. There exist patterns carrying a serious quantity of usable timber which have not been used within living memory.

The problem of making a pattern for a single casting is difficult to solve. The pattern has to be made as cheaply as possible, which means that time—the main cost of a pattern—will have to be reduced, to do this, means have to be provided to speed up the slower operations of the preparation of components of patterns, such as planing, paring, routing, trenching and trimming of the end grain of timber. To this end, the installation of proper machinery to execute these operations is essential.

Repeated Use of Patterns

Patterns for one-off jobs have a bad habit of being found necessary for a number of castings, with the result that the pattern shop receives complaints from the foundry about the pattern being difficult to withdraw from the mould, or that a waster has been made. Then, the pattern has to be reconstituted, sometimes costing more than a good pattern initially.

It is not through lack of skill on the pattern-maker's

* This Paper, read before the West Riding branch of the Institute of British Foundrymen, was awarded the S. W. Wise Memorial Prize.

Pattern Shop—Asset or Liability?

part, but the amount of work he is allowed to put into a job. A pattern-maker has as much pride in turning out a good pattern as any other craftsman.

What is a Good Pattern?

If there be a demand for a price for a pattern, either from a master pattern-maker or from a colleague in the works by way of piecework, a pattern will be produced bearing a relationship to that price. That is, the quickest method of construction with lack of thought for the moulder or concern about cutting out needless operations during the process of moulding. The only object achieved is that a pattern has been made!

Some patterns can obviously be constructed as a whole unit or in halves. The former, which from a pattern-making point of view, is often easier and quicker to make, results in an over-sized casting, by reason of carrying the moulding taper through the whole depth of the pattern to facilitate the joint being made more or less at the upper side of the pattern. This increases the moulding operations, causing the pattern to be bedded in for ramming up, the moulder having to do more tooling to make the joint, whilst bosses if incorporated have to be worked "loose."

The same pattern made in halves would take longer and cost more to make, but would require only half the dimensional oversize for moulding taper. It could easily be rammed up on a board, resulting in a level joint. Bosses and the like on the centre line can be fastened to the pattern, thereby reducing the moulding operations, the supervision for the correct positioning of loose parts, and the care in keeping the pattern equipment together.

Of course, this applies only to patterns of a design which can be made by these two methods, but what it is intended to stress is that if a pattern is required to be highly efficient, not only emphasise this but also be prepared to pay for it. By so doing the pattern shop can produce the required pattern to suit the best methods of production and not be concerned with the mere keeping down of pattern-making costs.

What is a Pattern Shop?

It is certainly not any ill-lighted building which can be pressed into service, where a man's initiative and constructive ability are cramped by overcrowded conditions; nor one in which enterprise is hindered by the type of machinery that has been installed—governed by the space available and not by requirements.

Such cases exist, but happily it is now being realised that pattern shop buildings and equipment require special treatment—an obvious factor is a maximum of daylight.

There must be plenty of room for the movement and handling of patterns and timber, without interfering with the operation of machines and the working of pattern-makers.

The machinery should be situated so as to be available to the whole shop, with a minimum of walking distance from bench to the machinery most used, which are usually bandsaw and sander. The circular saw and planing machine are preferably located near to the stock of timber.

Equipment

The potential output of the shop will govern the number of machines of the same type to be installed. For a large shop it is advisable to have a separate surface planer and a thickness planer, then the limitations of each are not governed by the other, and by reason of their design, are better to approach by the operator, who is sometimes encumbered by the attachments incorporated in combined machines. The latter, usually installed in a smaller shop, is an advantage. With two separate machines two operations can be performed simultaneously by two operators, and, moreover, the machines have a wider working range.

A great asset can be the provision of small surface planers with a 6-in. cutter head placed near the benches; these are appreciated by the pattern-makers for planing and bevelling small pieces of timber. As a medium-sized band saw may be found inadequate for big work and too large for small intricate work, thus a small one and a large one would be more suitable where the work is variable.

Band Saws

A really efficient band saw can make a great difference to the time taken in finishing a pattern after cutting out to shape, depending on how near it can be cut to the line with confidence. Not only should the machine be mechanically good, but great care should be taken of the condition of the saw blade. The saw guide should be easily and quickly adjustable. The work table, when required at an angle, should be controllably handwheeled and not be a major operation with a spanner. The outstanding faults of a bad saw blade can be due to antiquated brazing methods, which result in distorted joints and loss of temper. Faulty adjustment of the joint before brazing can result in the back of the blade being out of line—causing it to jump—or twisted, making it to flap about sideways. A saw should receive proper treatment with the file and sett.

Such defects retard the cutting speed and affect the finishing operation by not cutting sufficiently near to the line. The operations on a band saw are quite short—seldom more than a few minutes—but are often recurrent in the making of most patterns; thus, if even a small percentage of the time can be saved in easy adaptability and efficient cutting, it is well worth the extra supervision. There is available efficient electrical apparatus for the repair of band saws which is quick and easily applied without loss of temper and distortion of the blade.

Ancillary Machines

The other machines required to speed up production are those which will eliminate the slow trial and error operations of hand tools, such as a reciprocating bobbin sander with various sizes of bobbins and an adjustable work table. This type of machine is adaptable to a

great variety of inside radial finishing work, on a face, vertical, or at an angle from the vertical. This machine can be set to grind to the marking on the upper side of the pattern component, thus eliminating the necessity to mark out on both sides, which is usual in hand tool practice. Moreover, it does the work accurately and quicker.

A reciprocating saw, with an easily detachable blade for quick setting of the job on the work table, which is adjustable to give a cut at any angle, will greatly facilitate the cutting to shape of inside parts of the type impossible to do on the band saw, except by dismantling the parts requiring cutting. Besides the ordinary circular saw for general sawing, a circular cross-cut saw, capable of being set at an angle, is a useful, but not essential, machine. It can, however, reduce the cutting off of lengths of timber to a one-man operation, as it is both quicker and safer.

After the general preparation of timber by the usual methods, such operations as rebating, grooving, bevelling and concave cutting, can be done on a small saw bench with an adjustable table. These operations can speed up and improve the methods of construction of a pattern.

Lathe Work

In the wood turning section of a pattern shop very often there are found old metal turning lathes of obsolete design. Such machines have many faults, as the headstock design and the bearings are not suitable for the speeds necessary in wood turning. Again, they generally have to be driven by overhead belts, which makes it necessary for the use of a ladder or other unsafe method for changing the belt for different speeds. The design of the bed is generally of an upright nature, with a narrow base, which is insufficiently rigid for fairly heavy work at the speeds required, causing a lateral vibration which results in the turned pattern being slightly out of truth.

A lathe designed and very adaptable for pattern turning, is one that has a motor on a hinged base plate, with the cone pulley extending into the lower part of the machine head, which is constructed of one casting, having a fairly wide base and totally enclosing the driving arrangement. The changing over to the four speeds of the machine is a quite simple operation. A foot lever raises the motor base plate, releasing the tension on the belt, which is moved from one pulley to another by a fork connected to a lever on the outside and front of the head. The tension on the belt is supplied by the weight of the motor, which can be adjusted by a stop screw.

The turning spindle extends both on the bed side and the outside of the headstock. With a face plate on both sides, two jobs can be turned simultaneously by two men, providing the two jobs require a similar speed. The bed is not cumbersome, making it easy for the operator to get right up to his work with hand-turning tools. The starting and stopping switch-box is conveniently placed on the side of the bed, and a braking arrangement is fitted in the headstock for reducing the high speeds in a minimum time, when stopping the machine, which is very often required in the turning of some patterns.

This machine will take a face plate on the outside up to 5 ft. dia., and if fitted up with an easily adjustable tool rest and a variety of faceplates and other attachments, it can be a great asset for good, speedy work.

The Universal Pattern Miller

Whilst not exactly new, this machine has been progressively developed. It is made in two sizes, the smaller one being useful for either wood or alloy patterns. The larger model is capable of machining patterns of a few inches up to 9 ft. dia., and is of a substantial structure. The overhanging arm carrying the spindle head is mounted on sliding-ways on the main frame and can be raised or lowered by power or hand feed. The spindle head swivels between the vertical and horizontal in either direction, the cutter spindle being provided with a movement at right angles to the arm.

The work table has two motions at right angles operated by screw and hand wheel. The table also has a rotary movement for dealing with all kinds of circular and radius work. The table body frame and body move along the foundation frame rails. The cutter spindle can be fitted with a variety of attachments, using a large selection of cutters for nearly every conceivable design of milling operation.

The simple woodworking operations of this machine, such as half lapping, rebating and routing, can be an asset in the accurate and speedy construction of patterns. Half circular coreboxes with either a single diameter or with several diameters, can be built up with a rigid construction, marked out and machined to a high degree of accuracy, being better than machining by other methods and building up in sections.

This machine eliminates the difficulties encountered by the vagrancies of the grain of the timber. A great help in this direction is the ability to revolve the cutter in either direction and the cutter being able to work length-ways, cross-ways or end-ways of the grain. Patterns can be built up "rough" and then machined to a large percentage of their requirements, especially circular work; one advantage is that fillets can be worked in and correct angles maintained by the proper setting of the machine. The amount of work this machine can be found to do, in the hands of an operator familiar with the machine, has to be seen to be believed, the finished patterns, in most cases, being of a higher standard than those made by other methods.

Hand Trimmer

Another useful item of equipment is the hand trimmer, which can be used to good advantage for the building up of circular work by trimming the ends of sweeps, and for cutting pieces at definite angles for brackets. The trimming of components of patterns and coreboxes where it is needed on the end grain of the timber, is quicker and saves time over the sander.

For the building of patterns the ordinary work benches are not adaptable. To use them for this purpose hinders the working of components on the bench. Thus, it is a good plan to provide tables for this purpose. For large patterns a great asset is the provision of a metal table of dimensions to suit the size of the

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Pattern Shop—Asset or Liability?

patterns required, with slots for bolts or clamps for holding the patterns, and an angle bracket for fastening vertically. With the aid of such a table, patterns can be built up "true," and held firmly for cutting, paring, or screwing, as the table top serves quite well as a datum line for marking off by scriber block or for testing the pattern for correct shape.

Good Patterns

A good pattern is one which is (1) dimensionally accurate; (2) works with the maximum of efficiency in the foundry; (3) gives the maximum strength without undue weight, and (4) has the requisite amount of timber to retain shape whilst in the foundry. Some patterns, owing to their shape, are difficult to construct so as to be really robust. Having to be built up in sections to facilitate shaping and being finished by hand tools militates against strength; whereas, with adequate machinery available, a more solid and stronger construction can be assured.

Four illustrations will serve to show and describe instances where machinery is a definite advantage for speedier and better construction of patterns and core-boxes.

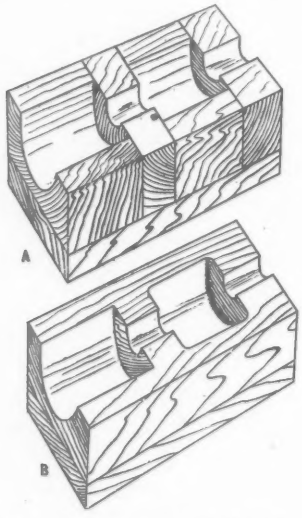


FIG. 1.—COREBOX FOR A VALVE STUFF-BOX COVER.

Fig. 1 shows a corebox for a valve stuff-box cover, or any corebox of similar design. At A is shown the corebox made by the usual methods, *i.e.*, it has to be made in sections—one to each diameter required—to facililtate cutting and finishing to shape. Each section has to be marked out separately, and when finished, requires glueing and fastening correctly in position with battens, whilst fillets have to be inserted afterwards.

By the second method, B, two pieces of timber only need be prepared. Marking out is simplified by limiting it to one face. The box then is machined out by the pattern miller and fillets are worked in. The resultant corebox is more robust, more accurate, and there is a saving in time and timber, associated with a longer life in core production.

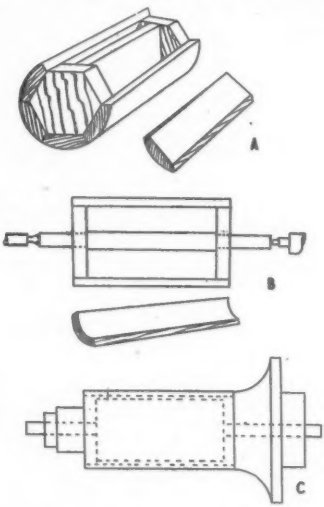


FIG. 2.—PATTERN FOR MAKING CYLINDRICAL CASTINGS, 12 TO 14 IN. DIA. AND 2 FT. LONG.

Cylinder Patterns

Fig. 2 shows a pattern for the production of a cylindrical casting of 12 to 14 in. dia., and about 2 ft. long. For one method—A—the components would consist of two hexagonal ends, one distance piece and six segments. These have all to be marked out and fitted correctly to size and requirements, the rigidity depending on the fit, glue, and fastening either by nails or screws. Close supervision is needed in keeping correct alignment. For a coreprint to be turned on at one or both ends, it needs a piece of the requisite thickness to be fastened on, as turning it out of the constructed part may result in feather edges of the segments, and maybe a weakening of the construction. For turning, this pattern requires that the ends be parallel for the adaption of face and centre plates.

A second method is shown at B. It requires less marking out and fitting, as it is of a more rigid construction and very adaptable, especially in respect to the fitting of other components, where it calls for the use of the small rebating sawbench. This method requires similar components built together in a different manner, which only require rough marking out and less fitting by reason of the construction. End discs are either bored or turned out to fit the spigot turned on the distance piece, which is reduced at each end to facilitate turning.

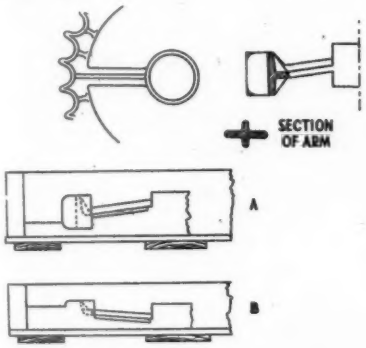


FIG. 3.—SHOWS A PATTERN FOR A TRACTOR SPROCKET WHEEL BEING SIMPLIFIED IN CONSTRUCTION.

With only the turning fork and centre being used, the distance piece is easily removed, the end discs are then fastened on, returned to the lathe and turned to an even diameter. The segments or laggings are cut to width and bevelled—the inside radius being cut by a pattern miller or circular saw. By the saw method, the blade is set to the depth of the required curve, the width being determined by a fence set at an angle.

The segments are more easily fitted than by the other method, as only the last one requires fitting to any definite size.. If only a small coreprint be required, the spigot ends of the centre piece can be turned to suit; or if larger prints be required, they can be fitted on and turned, or turned separately, without requiring marking out to fit, as they are centred by the spigots. For other patterns, other than the straight cylinder, the spigots can extend to provide setting to other components, being more accurate and rigid than fastening on a flat end.

Tractor Sprocket Wheel

Fig. 3 illustrates a pattern for a tractor sprocket wheel being simplified in construction by reason of the method of production of the casting, which does not require the pattern to be so constructed to hold together as a single unit. This particular casting was made in steel, using a centrifugal method embodying an oilsand mould. The pattern was constructed as a separate top and bottom piece on the base boards of circular boxes.

The pattern was built up and turned to form the boss, the joint face to the centre of the arms, which are of a cruciform section and at an angle to the wheel face, the joint continuing to the underside of the rim, thus ensuring an accurate uniform shape of the joint at one side of the teeth. The method requires no matching of the teeth between the two halves. The rim was turned separately in a block of a width and depth of the maximum dimensions of the rim, being machined to the shape of the joint recess in the base plate.

The teeth, and the inside of the rim, which follows the contour of the teeth with a $\frac{1}{4}$-in. section, were marked out, the outside of the teeth being cut by band saw and finished on the bobbin sander. The inside of the rim, if worked out by hand, would entail many hours of tedious work, so the pattern miller was used, and although it was not practical to mill it to finished requirements it needed very little trimming. The small brackets behind each tooth recess and all fillets were worked in. The arms, being made and fastened on the joint face, do not require fastening to the boss or rim. The other half is turned to suit the opposite side of the joint, the inside of the rim being milled out as the other half. This method of construction can be used for plate patterns instead of constructing the patterns first and then fastening them on a plate.

Pattern for a Bronze Acetylene Gas Container

This pattern (Fig. 4), being more or less hemispherical, carrying a flange and brackets, is turned as a block pattern with an overhung print, the inside being formed by the core which closes the mould instead of the use of a cope. It is of one feature of the pattern construction that it is desirable to draw a comparison of two methods—the usual construction, and a second, involving the use of the pattern miller.

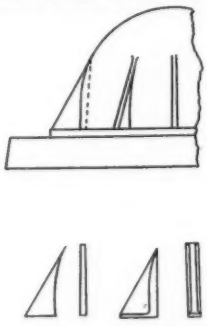


FIG. 4.—PATTERN FOR A BRONZE ACETYLENE GAS CONTAINER.

(*Continued on page* 92.)

I.B.F. DELEGATION TO AMERICAN FOUNDRY CONGRESS

THIS PHOTOGRAPH OF THE INSTITUTE OF BRITISH FOUNDRYMEN DELEGATION TO THE A.F.A. JUBILEE CONVENTION IN CLEVELAND, WAS TAKEN ABOARD THE "AQUITANIA." THE MEMBERS OF THE PARTY, FROM LEFT TO RIGHT, ARE: F. NIELD, M. ROYCE, D. MENZIES, G. BUSH, J. DEARDON, T. MAKEMSON, B. GRAY, A. JACKSON (FRONT), V. DELPORT (BACK), E. OWEN, F. TIBBENHAM, T. SHANKS AND T. LEE.

PUBLICATIONS RECEIVED

The Furnaceman's Manual. Published as Fuel Efficiency Bulletin No. 43, by the Ministry of Fuel and Power. Free of charge from 2, Little Smith Street, London, S.W.1.

The object of this bulletin is to explain the principles underlying the proper operation of furnaces. As furnacemen are normally restricted to the handling of one type of furnace, most of the pamphlet will be for information only. On the other hand, if the word "furnaceman" is intended to mean technicians in charge of a multitude of various types of plant, then the booklet is of distinct interest. The reviewer thinks that the time has arrived when this series could, without detriment to fuel efficiency, be terminated, as the ground has been well covered, and in the more recent issues duplication and a decrease in general utility is noticeable. Cupola operation is not included, but there are some notes on air furnaces, regenerative open-hearths, gas and oil burners, and the like.

The Bulletin of The Association of Bronze and Brass Founders. No. 1. For private circulation only.

This Bulletin is to be issued monthly to member firms of the Association, and is designed to keep them well informed, not only of the Association's activities, but also of external matters affecting their business. The first issue contains a foreword by the president, Mr. George Hyslop; the organisation of the Association; a complete list of members, and a number of industrial notes. Amongst these are articles dealing with E.P.T. Refund; the availability of reports from Germany; the British Non-ferrous Metals Federation: export credits; non-ferrous scrap and virgin metal prices; trade arrangements between Britain and European countries; production cost increases, and parliamentary representation. The editor is to be congratulated on his choice of material and its presentation.

DINAS ROCK SILICA QUARRIES, LIMITED, is being wound up voluntarily. Mr. J. L. Davies, 45, Wind Street, Swansea, is the liquidator.

TECHNICAL RECORDS IN THE FOUNDRY

The making of Caustic Pots, Loco Wheels and Card Cylinders featured in Practical Discussion

At the February meeting of the Lancashire branch of the Institute of British Foundrymen, held in the Engineers' Club, Manchester, Mr. S. Brooks presiding, Mr. R. D. Lawrie presented a Paper entitled "Technical Records in the Foundry." This was printed in our issue of April 11. Following the reading, an interesting discussion took place of which the following is an abstract.

Vote of Thanks

MR. TOM MAKEMSON, M.B.E., Secretary of the Institute, in proposing a vote of thanks to the Lecturer, said he was convinced that everyone would acknowledge the Paper's helpfulness, particularly the practical man. Upon first reading the title of the Paper, his mind immediately turned to forms, and seeing that he had spent the previous six years in inventing forms for foundrymen to fill in, and in inspiring letters of complaint because they had not done so, he had wondered what would be the outcome of the Paper. It was encouraging to discover that he was not the only individual who required forms, and that the foundryman was unable to conduct his affairs efficiently without their aid. The information which was sought to be recorded upon the forms mentioned by Mr. Lawrie was essentially important if a foundry was to be run upon modern systematic lines. The days when the foreman used to memorise everything had passed, and even so he was bound to die at some time, and then his knowledge would be lost to others.

MR. F. W. NIELD seconded the vote of thanks, and was convinced that there should be more and better kept technical records of casting.

The vote of thanks was carried unanimously by acclamation.

Mr. Lawrie suitably responded.

Caustic Pot Moulding

MR. A. SUTCLIFFE (Bolton) wished to know how the core for the large caustic pot was made?

MR. LAWRIE said the complete core was not turned upside down; only the bottom portion, which was made on a prodded plate. This prodded plate was set prods uppermost, on three blocks about 12 in. high, on top of a turnover plate; after strickling in the usual way, it was stoved and then turned over, being cottered to the turnover plate during the turning over operation. The turnover plate was next removed, and the prodded plate which had been strickled to the profile of the pot bottom, was set inside a dummy with sides about 9 in. higher than the plate. The spindle and board were now set in position, with the bottom edge of the board resting on the top surface of the dummy, and the remainder of the core built with a 9-in. wall in the usual manner. Only one crane was used to turn over. The core was built with loam bricks at three points, to facilitate easing after casting.

Clerical Assistance

MR. ALEC JACKSON (Accrington) remarked that quite a considerable amount of clerical work would be required to compile and file the records and graphs. How many clerks did Mr. Lawrie employ for the purpose? Another point was who decided upon the wasters? Many castings were returned to be scrapped for various reasons, but when an enquiry was made into the matter something entirely different was discovered. Therefore, the records might not prove to be of as much service to the foundry as they ought to be. He was speaking actually with regard to the foundry foreman, and the man on the floor. Such records might be of great value to the manager or superintendent of the foundry, but what about the man in the shop, would he have access to them? The foundry manager or superintendent might use them more or less as a whip for the foreman.

MR. LAWRIE said there was only one clerk to each of the four foundries, and he was not fully engaged on the work all the time, but was also assistant to the foundry manager. He was speaking about the technical records of castings. There were 5 sheets, each of which was forwarded to the appropriate foreman, who filled in his own data in his own time. The sheets were collected by the clerk. When they were compiled, the foreman had free access to them, because they were passed round so that every foreman could make his own notes for future guidance. All the records were sent to Mr. Lawrie's office, where an assistant copied them, and a full copy was sent to each foundry manager, and the chief metallurgist. Six copies were made in all.

There was a very complete inspection department to determine what castings were wasters, and this staff worked in close collaboration with the foundry foreman. A casting which was a waster would be, first of all, invariably found by the fettler, who would make a report to the fettler foreman, a copy of which is sent to the chief inspector. That official decided what was the cause of the waster, and his report was sent to the foundry manager, and the appropriate clerk. The reports were not kept merely as a form of library; every foreman had access to them.

Analytical Discrepancies

MR. NIELD, referring to an earlier statement of Mr. Lawrie's, said he wished to defend the work of the metallurgical chemist. Out of ten men making a particular investigation, nine of them would be in close agreement with regard to their conclusions.

MR. LAWRIE said he remembered some years ago, when employed on the manufacture of piston ring drums, he had had a batch rejected by a certain customer as not to specification for chemical analysis, in spite of the fact that his own works' analysis had shown them to be well within specification. Upon

referring the matter to his superior, who stated that perhaps the customer had been using a different chemical standard for his analysis; and instructed him (Mr. Lawrie) to prepare a bulk supply of fine turnings from a piston ring pot. This was divided up into separate samples and sent to ten of the principal laboratories in the country. When the results were received, it was found that no two were exactly similar, and finally the average of the three nearest was taken as representing the analysis of that particular sample. As a further example of different results on the same sample from different laboratories, Mr. Lawrie stated that when he examined the analysis of the first caustic pot, as determined by Stanton laboratory, he was perturbed to find that the T.C. was 3.51 per cent. instead of 3.4 per cent. When the check analysis came from the customer, he was relieved to find it within specification. Mr. Lawrie also read out the analysis of four separate test pips cast on to the same casting; these differed in several elements.

MR. H. HAYNES (Ashton-under-Lyne) mentioned a case of a metallurgist in a foundry which made large caustic pots up to 20 tons. He got confused in his tests when he cast three test castings in a moulding box. He tried this for six months and could not get the correct analysis in three castings with the same temperature of metal—the same ingates, the same runners, and the same temperature of sand. They all varied in regard to the tensile strength of the castings. It should be understood that he was not condemning metallurgists because they were necessary in every foundry, but they still had their own problems to solve.

Loco Wheel Moulds

MR. HAYNES was somewhat surprised at the tackle used in turning over the loco wheel moulds; just to have a stretcher across to the bar instead of sling chains with a pulley. He noticed that there were three runners with regard to the high-duty irons. Did Mr. Lawrie feed them, and were there fourteen risers?

MR. LAWRIE said there were eleven risers round the rim to allow free escape of air in the mould and no rod feeding was done.

MR. HAYNES did not think it was necessary to have the narrow risers round the high-duty wheel. The higher the temperature the casting could be cast in high-duty iron, the stronger it would be. With regard to taking the gases off, he would have thought that the pressure put on by the deep runner would be sufficient. Then there was the matter of blow holes, liquid shrinkage and cracks. Had any trouble been experienced in the fractures at the commencement of making the wheels, or any scabs. The reason he asked the question was to bring into consideration the venting of the sand.

MR. LAWRIE was pleased that Mr. Haynes had mentioned crude methods of turning over. The wheels were made under ordinary jobbing methods. Had he known that 7,500 of them would have to be made he would have had stripping plate patterns made, and the like. The first order was only for 2,000 and they were required so urgently that there was insufficient time to make all the desirable tackle. Although at Stanton there were twelve Sandslingers, they were all of the stationary type, with one exception, which was in another foundry, and fully employed. It was a question of utilising labour to the best advantage, the men concerned were accustomed to handling the rammer, so he made use of their services.

With regard to high-duty iron, the metal used for loco wheels was not truly a high-duty iron. To the average foundryman it was an ordinary iron of 16 tons tensile. It was an ordinary specification, although, on occasions, strengths up to 25 tons tensile have been obtained. The cupolas were in an entirely different shop and, consequently, temperature was not too good for casting. There was, however, freedom from air bubbles around the rim of wheel. The only time cracks had occurred had been when some clever individual thought normalising was not necessary; however, a certain amount of trouble was experienced, due to scabbing, but when ordinary steel moulders compo was used, the trouble was eliminated. Best quality prepared blacking gave the best results; the cheaper material was tried, but did not work successfully.

Card Cylinders

MR. J. JACKSON (Accrington) said the large production of card cylinders at Stanton foundry had received favourable comment, and he was pleased to find from the figures stated that the Stanton output per man was similar to that of his own foundry. Most people who had made card cylinders and doffers had experienced trouble with cracking. Had any system of stress relieving been adopted by the Lecturer? With regard to cracks, after giving due consideration to the proper metals, sand, etc., and considering also that when machined the cylinders had to retain a true concentricity, there might be a drop of five-thousandths of an inch if they were left in the machine. This was a matter for serious consideration. They were covered with wire, and they had to run very true. When considering the flats working on a 35-in. cylinder, the wires would probably be set down to seven or eight thousandths between the cylinder and the flats. It was found that the only practical method to adopt was to put them on end and weather them for two months before attempting to machine. This reduced the drop considerably.

MR. LAWRIE said he was very interested to hear Mr. Jackson's remarks, but, unfortunately, there was such a desperate hurry for the supply of the cylinders that they had to be dealt with in a matter of days. A point was made of seeing that they were kept on end for at least 48 hours. They could not be placed horizontally whilst hot, otherwise they would distort. The core was removed a few minutes after casting, but the casting itself was not removed from the mould until the following morning. So far as stress relieving was concerned, they had not done anything up to the present time. Production was at the rate of only 5 sets per day, but facilities were available for producing more, and arrangements were being made to increase output to 15 sets per day, as soon as the necessary labour could be obtained. They did not actually want

Technical Records in the Foundry

to make textile cylinders, because their "bread and butter" was pipes and pipe specials.

Metal for Caustic Pots

MR. R. S. YEOMANS (Manchester), speaking with reference to the caustic pots, asked whether Mr. Lawrie de-sulphurised the iron, and if so, did he then add nickel to the metal? Was the location of the top part and the bottom done with the ordinary seating arrangements, or were there sight holes?

MR. LAWRIE said that with regard to the adding of the nickel, he had a complete cupola sheet which showed the whole job. This stated that 18 lb. of nickel per ton was added at the cupola spout. De-sulphurising was also carried out in the ladle by means of the addition of 25 lb. per ton, of soda ash. A certain amount of de-sulphurising was also done in the cupola, and they did, for a certain time, add a proportion of sodium carbonate to the charge.

MR. YEOMAN asked whether there was any use in making an addition to the cupola?

MR. LAWRIE replied that it helped a little, but de-sulphurising in the ladle was perhaps the more effective, although it made a mess of the ladles. Location of the top and bottom parts of the caustic pot moulds was achieved by the normal male and female joints, common to loam moulding.

The proceedings then concluded.

GERMAN TECHNICAL REPORTS

Six reports of interest to the foundry industry are contained in the recent list made by Commissions visiting Germany. These reports are obtainable from the Board of Trade, Millbank, London, S.W.1. The post-free price is given in brackets. B.I.O.S. 203—the non-destructive testing of materials and X-ray protection methods (1s. 1d.). B.I.O.S. 327—Dandy roll-making industry (1s. 1d.) C.I.O.S. XXVII-94—Vereinigte Deutsche Metallwerke A.G.; description of plant manufacturing semi-finished forms of alloy and non-ferrous metals (2s. 1d.). B.I.O.S. 341—German chemical plant manufacture; mixing and grinding machines (1s. 1d.). C.I.O.S. XI-9 mechanical and metallurgical targets—Savoy region; visit to five research laboratories (1s. 1d.) C.I.O.S. XXXI-44—heat-resisting and corrosion-resisting alloy steels, F. Krupp A.G. Essen (2s. 2d.).

LABOUR WORRIES UNDER E.W.O.

(*Continued from page* 82.)

In conclusion, the Author would like to draw attention to the ease with which medical certificates are obtained by known malingerers. The regrettable increase in illness indicated by these "notes" is hardly compatible with repeated medical statements in the Press regarding the improved health of the nation in spite of rationing.

NEW CATALOGUES

Fluxes.—A four-page leaflet received from Multiple Acting Flux, Limited, of 13, Havelock Square, Sheffield, 10, lists a range of fluxes, most of which are for use in the foundry industry.

Thermit Welding. A four-page illustrated pamphlet received from Murex, Limited, of Rainham, Essex, describes the underlying principles of thermit welding, and discloses schemes for the repair by the Company's specialists of broken heavy components and for the training of customers' employees, so that when a break does occur, there will be no need to rely on outside help for such repair work.

Ferro-Alloys (and the like). Two catalogues, both artistically presented in blue with white bands, and a medallion inset, have been received from Murex, Limited, of Rainham, Essex. The first deals with metallurgical and chemical products. This includes a wide range of alloys for steel, iron and non-ferrous metal manufacture. They are offered as lumps, powders and carbides. They also make fine chemicals, covering compounds containing W, Mo, and V.

Finally, they make tungsten carbide products. The second brochure sets out the specifications and typical analyses of a number of the products briefly listed in the former. Buyers for the foundry industry should procure and file these pamphlets, as some of the items listed do not rank as common knowledge in foundry circles.

FURTHER EDUCATION AND TRAINING SCHEME

Appeal tribunals have been set up to assist the Government departments concerned with the administration of the Further Education and Training Scheme, under which assistance may be given to persons whose further education or training was interrupted or prevented by their war service. The Government departments concerned are the Ministry of Labour and National Service, the Ministry of Education, the Ministry of Agriculture and Fisheries, the Scottish Education Department and the Department of Agriculture for Scotland.

The tribunals will hear appeals, referred to them at the discretion of the Minister concerned, from persons whose applications for awards have been refused on the ground that their personal suitability for the course of training or education required is not established. There will be one tribunal for England and Wales which will also deal with cases arising in Northern Ireland, and one for Scotland. The chairman of the tribunal for England and Wales is the Marquess of Reading, C.B.E., M.C., T.D., K.C. Amongst the members of the Panel is Mr. V. A. Patterson, of J. & E. Hall, Limited, Dartford, Kent.

THE ROBERTSON ENGINEERING COMPANY, LIMITED, is being wound up voluntarily. Mr. A. G. White, 73, Cheapside, London, E.C.2, is the liquidator.

PATTERN SHOP—ASSET OR LIABILITY?

(*Continued from page* 87.)

The usual method of fitting the brackets is to shape them to the contour of the pattern body and flange, fastening them in position by screws or nails at the ends, the fillet, usually leather, being glued in afterwards. This method is quite satisfactory for a few castings, but for use for a large number the brackets are liable to work loose or even split at the fastening by continual ramming and rapping.

The other method of inserting the ribs or brackets below the contour of the pattern facilitates the working in of the fillet, also providing a more rigid fitting of the brackets. This can be a long and tedious job if carried out by hand tools, but, bringing the pattern miller into operation, can make it quite a simple one. The slots after marking out can easily be milled, the brackets fitted in as a solid piece. The thickness, being the width of the slot, is marked off to the contour of the body.

The brackets then being removed and clamped on a tapered wood jig, to give the required moulding taper, they are milled to the required thickness, leaving in the fillet. The brackets then have side pieces through which they can be fastened.

Conclusion

In this Paper, the Author has tried to show how better patterns can be made by the use of efficient machinery, being in most cases quicker and more accurate and of a stronger construction. He has only dealt with wood patterns, mostly for small castings. Metal patterns, which are increasing in use, are another subject which requires different technique, and is only one of the many problems encountered in pattern-making, of which the Paper only gives a brief outline.

DISCUSSION

The President (MR. J. TIMBRELL), said foundrymen considered they had their own ideas about the pattern shop. Mr. Padley had satisfied the members that the pattern shop was a definite asset to the foundry if properly organised and staffed.

After a number of questions on points of detail had been answered by the Author, the PRESIDENT asked Mr. Padley whether he thought the training of youth in pattern-making was likely to suffer by the extension of use of machinery, and whether craftsmanship would suffer if use of such machine methods were introduced into the training itself?

MR. PADLEY said that an apprentice was not supposed to use a machine until he was 18. If he underwent a proper training he was taught to use his tools. Skill remained an important factor and the man who could use his own tools properly was more likely to do machine work more quickly and effectively when called upon to do so. The pattern shop was not, of course, producing an article of furniture, but the pattern had to be as good and accurate as possible. There was, admittedly, always the human element to be considered in the use of hand tools, especially if the grain of the timber was difficult, and it could not be denied that the machine might well do the job better than when reliance was placed on hand tools, but the man who had skill was wasting his time if he used it merely for cutting a piece of timber when he could be doing that by machine and using his personal skill in better designing and similar work.

MR. H. FORREST (past-President) supported Mr. Padley in suggesting that the skill of the pattern-maker should be directed to the best possible production. The more machinery that could be employed to ensure improved quality, the better, but that did not get away from the fact of the need for skill and the value of skill as an asset to the foundry firm in the pattern shop. All the same, whilst one deprecated the passing of certain types of skill there was the need to recognise that speed—subject to accuracy—was an essential in modern foundry work, and that was some justification for the use of machine methods.

Speaking as one of the trustees of the Wise Memorial Fund Competition, Mr. Forrest reminded the meeting that the primary aim of the award was to encourage younger members of the industry to attempt Papers of a character envisaging developments and possibilities of the future in their particular sections of the foundry trade. He invited intending contestants for future years to keep that aspect of the award in mind. The call was for a look into the future, as seen by the younger men, rather than anything in the way of a review of the present. Many new types of work had been introduced into founding in recent years, and should, the Awards Committee believed, provide a valuable foundation for the ideas of the rising generation of craftsmen to vision possible developments. It was mainly on this basis that the Wise award was intended to be made.

MR. PADLEY said that in times past the patterns for the foundry were made largely under direction of a millwright, and the result left to the moulder to work out as best he might, but modern pattern-making was more complex, and he hoped on a future occasion that he might be able to go more into detail on future trends in pattern-making.

MR. FORREST said he entirely agreed that present methods of production called for something different from the old ways. They were, he thought, rather looking now for some ideas in the direction of cold setting plastic or other synthetic patterns which could be used to get more or less unlimited numbers of moulds off.

The lecturer was thanked on behalf of the meeting by Mr. Simpson, seconded by Mr. H. Balme.

TRADE UNION AMALGAMATION

The Quarterly Journal and Report of the National Union of Foundry Workers details the voting of the various unions on the question of amalgamation. The outcome is that the Ironfounding Workers' Association and the United Metal Founders' Society are now part and parcel of the National Union of Foundry Workers, whilst the General Iron Fitters' Association and the North of England Brass Moulders remain independent.

PIG-IRON AND STEEL PRODUCTION IN GREAT BRITAIN

The following particulars relating to pig-iron and steel production in Great Britain during March have been extracted from the Statistical Bulletin for April, 1946, issued by the British Iron and Steel Federation. Table I gives the production of pig-iron and blast-furnace alloys, with the number of furnaces in blast at the end of March; Table II, production of steel ingots and castings in March; and Table III, deliveries of alloy and non-alloy finished steel. Table IV summarises the activities of the steel industry as a whole during the six months ended March, 1946.

TABLE I.—*Production of Pig-iron and Blast-furnace Ferro-alloys by Quality and District.*
(*Thousands of Tons.*)

District.	Furnaces in blast, 30.3.46	Weekly average production, March, 1946. Hematite.	Basic.	Foundry.	Forge.	Ferro-alloys.	Total.
Derby, Leics., Notts., Northants and Essex	21	—	15.7	16.0	1.4	—	33.1
Lancs. (excl. N.W. Coast), Denbigh, Flints, and Ches.	7	—	6.0	—	—	1.6	7.6
Yorkshire (incl. Sheffield, excl. N.E. Coast)							
Lincolnshire	12	—	18.3	—	—	—	18.3
North-East Coast	25	5.6	28.6	0.3	—	1.2	35.7
Scotland	10	0.5	9.2	2.1	—	—	11.8
Staffs., Shrops., Worcs. and Warwick	8	—	5.6	1.4	—	—	7.0
S. Wales and Monmouth	7	3.0	17.5	—	—	—	20.5
North-West Coast	7	12.4	—	0.9	—	—	13.3
Total	97	21.5	100.9	20.7	1.4	2.8	147.3
February, 1946	98	22.3	98.5	20.8	1.8	2.7	146.1
March, 1945	102	21.5	100.2	16.8	0.5	2.4	141.4

TABLE III.—*Deliveries of Alloy and Non-alloy Finished Steel.*
(*Thousands of Tons.*)

Product.	Weekly average. 1944.	1945.	1945. Mar.	1946. Feb.†	1946. Mar.
Heavy rails and sleepers	6.5	7.1	7.6	9.4	9.9
Heavy and medium plates	30.8	26.4	29.1	30.6	32.4
Plates—alloy	1.9	1.1	1.6	0.4	0.4
Other heavy steel products	38.2	33.1	43.9	31.9	32.8
Light rolled products (excl. wire rods and alloy-steel bars)	46.2	41.9	45.6	46.6	50.8
Ferro-concrete bars	2.1	1.8	1.5	2.3	3.6
Cold-rolled strip (excl. alloy)	4.2	4.0	4.6	4.1	4.1
Bright steel bars (excl. alloy)	4.9	3.9	4.3	3.8	4.0
Sheets, coated and uncoated (excl. alloy)	21.2	20.2	23.2	22.5	23.4
Tin, terne and blackplate	10.0	9.5	10.9	10.1	11.2
Tubes, pipes and fittings	12.9	11.2	12.4	13.9	15.3
Steel wire (excl. alloy)	12.2	10.2	11.4	11.9	12.3
Alloy bars, sheets, strip and wire	5.6	3.0	3.5	2.7	2.8
Steel tyres, wheels and axles	2.6	2.5	2.5	2.6	3.4
Steel forgings	10.9	7.5	9.1	6.6	6.7
Steel castings	6.8	5.0	6.7	3.5	3.8
Total production*	217.0	188.4	217.9	202.9	216.9
Less intra-industry conversion	24.5	17.8	21.9	16.9	16.3
Total deliveries	192.5	170.6	196.0	186.0	200.6
Deliveries of imported finished steel	5.0	1.0	1.6	—	—
Total deliveries of finished steel	197.5	171.6	197.6	186.0	200.6

* Includes finished steel produced in the U.K. from imported ingots and semi-finished steel.
† Revised.

TABLE II.—*Production of Steel Ingots and Castings (including Alloy) by Process and District.* (*In Thousands of Tons.*)

District.	Weekly average production, March, 1946. Open-hearth. Acid.	Open-hearth. Basic.	Bessemer.	Electric.	All other.	Total. Ingots.	Total. Castings.	Total ingots and castings.
Derby, Leics., Notts., Northants and Essex	—	—	(Basic) 9.7	1.1	0.3	10.7	0.4	11.1
Lancs. (excl. N.W. Coast), Denbigh, Flints., and Ches.	0.9	18.4	—	1.3	0.3	20.1	0.8	20.9
Yorkshire (incl. Sheffield, excl. N.E. Coast)	—	23.4	—	—	0.1	23.4	0.1	23.5
Lincolnshire	3.1	46.7	—	0.5	0.3	49.5	1.1	50.6
North-East Coast	6.2	31.8	—	0.5	0.5	37.7	1.3	39.0
Scotland	—	13.6	—	0.5	0.5	13.7	0.9	14.6
Staffs., Shrops., Worcs. and Warwick	5.5	42.2	(Basic) 5.2	0.6	0.1	53.3	0.3	53.6
S. Wales and Monmouthshire	9.0	20.7	—	4.8	0.6	33.7	1.4	35.1
Sheffield	0.3	3.0	(Acid) 4.0	—	—	7.3	—	7.3
North-West Coast	25.0	199.8	18.9	9.3	2.7	249.4	6.3	255.7
Total	23.9	191.2	19.5	9.5	3.1	240.6	6.6	247.2
February, 1946	21.4	188.2	18.4	12.0	0.1	234.1	12.0	246.1
March, 1945								

(*Continued at foot of next page.*)

PERSONAL

MR. J. V. DANIEL and MR. C. W. SCOTT have been appointed executive directors of Crompton Parkinson, Limited.

MR. PERCY LISTER, chairman of R. A. Lister & Company, Limited, engineers and ironfounders, of Dursley, Glos., is making a world tour to contact the firm's subsidiary companies, agents and customers.

MR. KENNETH NIGHTINGALE, managing director of Burt Bros., Limited, brassfounders, etc., of Birmingham, has been elected chairman of the Birmingham branch of the Incorporated Sales Managers' Association.

MR. S. E. INNES has resigned his position with the Board of Trade in order to join the board of Musgrave & Company, Limited, St. Ann's Ironworks, Belfast. He was with the Iron and Steel Control throughout the war period.

MR. WILLIAM RAESIDE has been presented with a gold watch and a long-service certificate by the directors of G. & J. Weir, Limited, Holm Foundry, Cathcart, Glasgow, S.4, to mark their appreciation of his 50 years' service.

MR. GEORGE WALL, formerly chief engineer with Stewarts and Lloyds, Limited, at Corby, had a narrow escape in a fire at the headquarters of the Military Government in the Hanover Region. He was badly burned while escaping from the building. Mr. Wall is associated with the metallurgical branch of the Allied Control Commission and is a civil Military Government officer.

MR. E. M. JOHNSON, who has been appointed chief engineer of the large electrical machine (plant) department of Metropolitan-Vickers Electrical Company, Limited, has been associated with various branches of the company's engineering work. For the past eight years he has been responsible for the design of large waterwheel alternators, synchronous condensers and other salient pole machines.

LORD WESTWOOD has retired from the position of general secretary to the Ship Constructors and Shipwrights' Association, Newcastle-upon-Tyne. He is succeeded by MR. J. WILLCOCKS, who was acting general secretary throughout the war, when Lord Westwood was occupied at the Admiralty as Chief Industrial Adviser. Before that Mr. Willcocks was assistant secretary for a number of years. He is president of the Confederation of Shipbuilding and Engineering Unions.

DR. R. H. BARFIELD, D.Sc., is shortly joining the research and development staff of Wild-Barfield Electric Furnaces, Limited, Elecfurn Works, Watford By-Pass, Watford, Herts. Dr. Barfield is well known in radio and electrical circles on account of the contributions he has made to scientific developments over the past 20 years. He is at present on the research staff at the National Physical Laboratory, from whom he was seconded during the war to assist in work of special importance in the Army.

Wills

MOSELEY, W. M. A., proprietor of Moseley Centrifuge & Engineering Company, London, N.1 ... ... £78,466

SAMUELSON, FREDERICK, a director of British Thomson-Houston Company, Limited £40,661

APRIL PIG-IRON AND STEEL PRODUCTION

The table below shows pig-iron and steel production in the United Kingdom in April, 1946, with figures for earlier months for comparison.

Steel production was at the rate of 13,111,000 tons a year, compared with a rate of 12,302,000 tons in the same month of last year. The decline compared with March, due to the Easter holiday, was less this year than last.

Pig-iron output increased further, the annual rate of April production being 7,732,000 tons a year, compared with 7,154,000 tons for April, 1945.

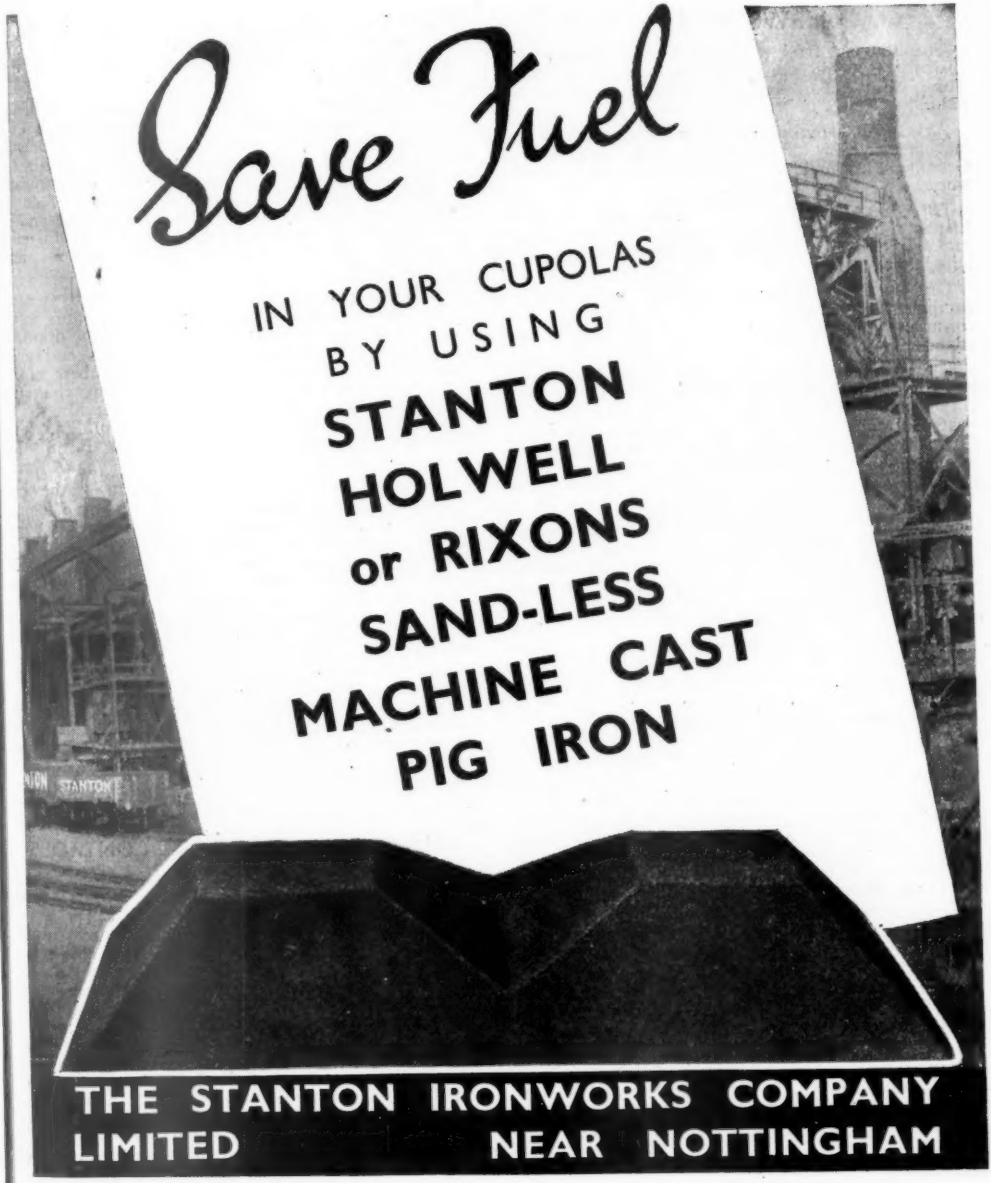
	Pig-iron.		Steel ingots and castings.	
	Weekly average.	Annual rate.	Weekly average.	Annual rate.
	Tons.	Tons.	Tons.	Tons.
1946—April ..	148,700	7,732,000	252,100	13,111,000
March ..	147,300	7,660,000	255,700	13,295,000
February	146,100	7,600,000	247,200	12,854,000
January ..	143,600	7,467,000	228,800	11,898,000
1945—April ..	137,600	7,154,000	236,600	12,302,000
March ..	141,400	7,354,000	246,100	12,799,000
February	136,700	7,109,000	241,400	12,553,000
January ..	127,100	6,609,000	216,300	11,248,000
1938—Year ..	130,000	6,761,100	200,000	10,397,900

PIG-IRON AND STEEL PRODUCTION IN GREAT BRITAIN (*Continued from previous page.*)

TABLE IV.—*General Summary of the Pig-iron and Steel Industry.* (*Weekly Average in Thousands of Tons.*)

Period.	Iron ore output.	Imported ore consumed.	Output of pig-iron and ferro-alloys.	Scrap used in steel-making.	Output of steel ingots and castings.	Deliveries of finished steel.	Steel stocks* held by producers, etc.
1944	297.6	46.8	129.5	141.7	233.5	197.5	2,171.0
1945	272.5	77.2	136.7	138.5	227.3	171.6	1,683.9
1945—October	247.4	106.3	146.1	146.1	243.0	166.5	1,211.5
November	249.0	104.4	150.0	147.3	246.9	179.4	1,212.5
December	231.4	100.4	145.5	131.9	221.5	164.2	1,189.7
1946—January	245.3	96.7	143.6	134.8†	228.8	173.4	1,223.9
February	256.1	99.6	146.1	146.7†	247.2	186.0†	1,197.8†
March	256.4	108.1	147.3	155.0	255.7	200.6	1,175.3

* Stocks at the beginning of the years and months shown, including material in transit.
† Revised.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NEWS IN BRIEF

THE BRITISH IRON & STEEL CORPORATION (SCRAP), LIMITED, is being wound up voluntarily. Mr. W. N. Tomkinson, 7, Park Lane, London, W.1, is the liquidator.

AVELING-BARFORD, LIMITED, manufacturers of road machinery, dairy and cooking apparatus, etc., of Grantham, are making considerable extensions to their works.

THE RELIABLE TOOL & ENGINEERING COMPANY, LIMITED, is to be wound up voluntarily. Mr. H. V. McLaren, 27, Taylor Road, Wallington, Surrey, is the liquidator.

THE FIRST prefabricated electricity sub-station and equipment to be built completely in Wales has been constructed by the South Wales Switchgear, Limited, at their Treforest Trading Estate works.

THE PARTNERSHIP between Basil Drummond Parsons and Charles Robert Tyson, carrying on business as engineers and sheet-metal workers at 11, Bawdale Road, East Dulwich, under the style of Tyson, Parsons & Company, has been dissolved by mutual consent. The business will be carried on in the future by Charles Robert Tyson.

A. C. WICKMAN, LIMITED, Coventry, announce that they have been appointed sole agents and engineering representatives throughout the world for the 10-gramme hand-operated injection moulding machine, designed and manufactured by the Nene Valley Tool Company, Limited, who are also developing power-operated machines of 1-oz. and 2-oz. capacities.

THE LORD MAYOR OF BIRMINGHAM, Ald. A. S. Giles, accompanied by the Lady Mayoress and some of the chiefs of the municipal staffs and lecturers from Birmingham University, recently visited the works of George Ellison, Limited, switchgear manufacturers, etc., and Tufnol, Limited, makers of electrical insulating materials, both of Perry Bar, Birmingham.

MR. A. W. BERRY, director of the British Engineers' Association, is attending the annual Manifestation Scientifique in Brussels, promoted by the Société Royale Belge des Ingénieurs et des Industriels, which began on May 13. Among contributors from the United Kingdom are Sir Edward Appleton, Dr. C. H. Desch, Mr. C. W. Marshall, and Mr. R. B. Shepherd.

ACCORDING TO official figures, out of a total working population of 20,695,000 at the end of February, 3,123,000 were in the Armed Forces and auxiliary services and 1,345,500 engaged on equipment and supplies for the Forces. At the same date there were estimated to be 6,157,700 employed in manufacturing; 875,000 ex-Forces had not yet taken up employment and 356,000 were unemployed.

SPEAKING AT THE ANNUAL MEETING of Robey & Company, Limited, Mr. W. T. Bell, chairman and managing director, said the demand, mainly for export, for their standard products, particularly colliery and mining plant, had been very heavy. They were producing exports for all parts of the world except the United States. In spite of statements made as to American efficiency, they were confident that they could compete, even in the United States, if it were not for their tariff wall, he added.

A CONFERENCE OF women shop stewards, representing 50,000 women members of the Amalgamated Engineering Union, have adopted a resolution expressing profound regret that the employers placed such a low value on the services of women that they were prepared to offer them only "a miserable increase" of 4s. 6d. The union's rejection of the offer was endorsed and the basic claim for equal pay for equal work and a minimum rate not less than the district rate for male labourers was reaffirmed.

A ROYAL COMMISSION has been appointed to determine what awards should be paid to inventors in respect of the use of their inventions, designs, drawings, or processes by Government departments and allied Governments during the war. The members of the Commission will be:—Lord Justice Cohen, chairman; Mr. K. R. Swan, K.C., deputy chairman; Mr. G. M. Bennett; Lt.-Col. Sir John Greenly; Lt.-Col. Sir George Lee; Sir James Rae; Sir William Stanier, F.R.S. The secretary is Mr. R. G. Lloyd.

OWING TO DIFFICULTIES experienced during the transition from war to peacetime production, the Glanmor Foundry Company, Limited, gave its employees notice of the closing of the works on May 18 for an indefinite period, but after further negotiations with Government departments, it was decided to postpone the notices for another fortnight. This would give time for a deputation from the men to go to London to meet Mr. James Griffiths, M.P. for Llanelly and Minister of National Insurance, and Mr. John Wilmot, Minister of Supply, so that fresh proposals might be discussed. Glanmor Foundry was established about 60 years ago. During the war it was under the managership of Mr. A. Whiteley, who was loaned to the company by the Iron and Steel Control. During this time the foundry was enlarged in order to produce heavy bombs.

RELAXATIONS OF EXPORT CONTROLS

Further relaxations of export control are made by a Board of Trade Order (S.R. & O. 1946, No. 667, H.M. Stationery Office, Kingsway, London, W.C.2, price 1d.) which comes into operation to-day (Thursday). Supply considerations have rendered it necessary to impose export licensing control on zinc oxide (including leaded zinc oxide) and di-iodohydroxyquinoline and export licenses will be required in respect of these goods as from to-day. The removals and modifications include: Group 6(2), under the heading "Manufactures wholly or mainly of iron or steel," to the items—baths (domestic) enamelled, cooking and heating appliances (gas) of a kind used for domestic purposes, the following have been added:—Boiling plates and heating plates, cookers, and grill boilers, these items having been transferred from the heading "Manufactures wholly or mainly of non-precious metal," which has been deleted.

Design by Victor Reinganum

MOSAICS OF STEEL

NUMBER FOUR

Samuel Fox and Company Limited have made the production of alloy steels their special care, and the great output of these high quality steels has had far reaching results both in peace and war. Not until metallurgists gave the engineer steels capable of withstanding heavy stresses without failure by fatigue, was it possible to make high speed mechanisms which were reliable. Thus the motor vehicle; the aircraft with its superb engines; the high pressure boilers and giant turbines of the modern power station are typical results of the development of alloy steels. By adding nickel, chromium, molybdenum, vanadium and other rare metals to steel, there becomes available a range of new materials of special properties to meet the most exacting needs of engineering.

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THOS. BUTLIN & CO., WELLINGBOROUGH

USP.48

COMPANY RESULTS

(Figures for previous year in brackets.)

R. A. Lister & Company—Interim dividend of 5% (same).

Marshall, Sons & Company—Interim dividend of 3¼% (same).

Atlas Steel Foundry & Engineering—Interim dividend of 15% (same).

F. H. Lloyd & Company—Final dividend of 7%, making 10% (same).

Cochran & Company, Annan—Interim dividend of 1½%, tax free (same).

Rio Tinto—Net revenue for 1945, £147,720 (£54,705); forward, £644,394 (£545,425).

Heatrae—Net profit to February 28, £13,959 (£15,192); dividend of 12½% (same); forward, £7,356 (£7,500).

Ransomes & Rapier—Net profit for 1945, £30,661 (£29,603); final dividend of 4%, tax free, making 6%, tax free (same).

Bairds & Scottish Steel—Net profit for 1945, £103,241 (£90,135); dividend of 6% (same); forward, £100,791 (£84,490).

Hopkinsons—Net profit for year ended January 31, £102,093 (£89,498); dividend of 20% (same); forward, £118,617 (£116,399).

James H. Lamont & Company—Net profit for 1945 £35,838 (£25,657); final dividend of 20%, making 25%; forward, £2,122 (£2,101).

John Summers—Dividend of 8½% on the ordinary stock as recently reorganised (8½% on the "A" stock and 4½% on the "B" stock).

Boulton & Paul—Net profit to September 30, after depreciation, £109,422 (£120,932); dividend of 10% (same); forward, £28,628 (£26,978).

G. Beaton & Son—Net profit for 1945, £13,072 (£12,629); dividend of 10% (same) and bonus of 5% (same); forward, £1,219 (£1,397).

Coventry Gauge & Tool—Net profit for 1945, £52,052; dividend of 7½%, tax free, and a bonus of 7½%, tax free; forward, £156,535 (£94,041).

Cargo Fleet Iron—Profit to September 30, after providing for deferred repairs, £154,192 (£157,939); no dividend (as before); forward, £99,815 (£99,408).

Projectile & Engineering—Net profit for 1945, £29,579 (£39,687); final dividend of 7½% (12½%), making 15% (20%); forward, £54,908 (£49,454).

Barrow Hematite Steel—Net profit for 1945, £47,030 (£81,579); to general reserve, £20,000 (£30,000); dividend of 10% (7½%); forward, £43,487 (£55,356).

Laurence, Scott & Electromotors—Net profit for 1945, £104,266 (£110,032); dividend of 12½% on "A" and "B" ordinary shares (same); forward, £8,051 (£7,029).

Glenfield & Kennedy—Net profit to March 31, after tax, £63,950 (£59,684); final dividend of 5% and bonus of 10%, making 20% (same); forward, £40,843 (£44,105).

Sturtevant Engineering—Trading profit for 1945, £50,909 (£50,343); final dividend of 9¼%, tax free, making 14¼% (11¼%), tax free; forward, £13,305 (£10,510).

Alexander, Fergusson & Company—Profit for 1945, after taxation and contingencies, £16,700 (£13,934); dividend on the "A" and "B" shares of 16% (12½%), tax free; forward, £16,193 (£15,695).

Newman Industries—Profit for 1945, after fees, pension premiums, depreciation, etc., £82,608 (£82,652); final dividend of 12½% (same) and a bonus of 2½% (same), making 22½% (same); forward, £22,620 (£20,366).

Ransomes, Sims & Jefferies—Net profit for 1945, after providing for E.P.T. and income-tax, £57,534 (£43,116); ordinary dividend of 7½% (same); pensions, £15,000 (same); general reserve, £15,000 (nil); forward, £64,133 (£62,724).

Stewarts and Lloyds—Trading profit and dividends for 1945, after E.P.T., £3,720,947 (£3,363,028); income from allied companies, £341,172 (£226,729); directors' fees, £15,000 (same); employees' funds, £132,729 (£131,133); debenture redemption, £36,780 (£35,354); debenture interest, £90,720 (£92,146); depreciation, £623,285 (£624,612); income tax, £1,605,701 (£1,484,504); net profit, £1,565,221 (£1,219,091); preference dividend, £125,175 (£121,202); deferred dividend of 12½% (same), £591,953 (£534,050); forward, £352,392 (£254,299).

OBITUARY

MR. H. T. DENTON, secretary of Belliss & Morcom, Limited, engineers, of Birmingham has died at the age of 76. He joined the firm in 1901 and was appointed secretary in 1913, and a director in 1942.

MR. E. C. GREIG, who quite recently resigned his position as chief labour superintendent of the United Steel Companies, Limited, died on May 13. He left Wishaw in 1898 to become chief chemist to the Frodingham Iron & Steel Company, later being appointed steelworks manager. From 1925 to 1929 he was the works manager of Steel, Peech & Tozer, when he became chief labour superintendent of the United Steel Companies. Mr. Greig was 68 years of age.

"ATOMIC PHYSICS AND MECHANICAL STRENGTH OF METALS" was the subject of the annual May lecture given by Prof. N. F. Mott, F.R.S., before the Institute of Metals yesterday (Wednesday).

AT THE FUNERAL of Mr. Wesley Lambert, C.B.E., which took place at the Crematorium, Charing, Kent, the Institute of British Foundrymen was represented by Mr. John Bolton, acting secretary, and Mr. V. C. Faulkner, past-president.

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Raw Material Markets

IRON AND STEEL

Active conditions are now ruling at most classes of foundries. Light-castings makers have been fully employed for some time, but it has taken longer for the engineering, jobbing and speciality foundries to return to peacetime operations. They are now getting into their stride, however, and are using considerable tonnages of pig-iron as well as large quantities of both steel and cast-iron scrap. Pig-iron supplies are satisfactory, but there are difficulties in various parts of the country in obtaining full supplies of scrap. The irons used by the general engineering foundries are in the main low- and medium-phosphorus grades, although considerable use is made of hematite and refined pig-iron and to a very limited extent high-phosphorus iron. This latter type of iron is utilised almost exclusively by the light-castings industry. Up to the present the Control have been able to distribute sufficient high-phosphorus iron to meet the foundries' needs, but further expansion in this branch is inevitable if housing construction is not to be hampered. In many districts there are shortages of castings necessary in housing construction both for external and internal use apart from the light castings which are wanted in large quantities for heating, cooking and other domestic purposes.

Considerable supplies of coke are essential to cover all the foundries' requirements. Up to now the position has not been too bad, but supplies now coming forward are only just about sufficient to meet immediate requirements, whereas many foundries want supplies over and above this in order to maintain their stocks at a reasonable level. No difficulty is experienced in getting limestone, ganister and other foundry requirements.

Large tonnages of billets are going into consumption due to activity at the sheet works and rolling mills. In recent months there has been a heavy demand for casement sections for housing purposes and this can be expected to develop further. The output of billets has improved, but, even so, home deliveries are not sufficient to keep the re-rollers fully engaged. Imported supplies are not so heavy as are needed, but the Control are endeavouring to get additional tonnages. Makers of semis have no accumulation of defective billets or crops, as these are taken up by the re-rollers immediately they arise.

There is a big demand for all forms of commercial steel in joists, sections, plates and sheets. The sheet and plate mills are booked up to the end of the year. There has been a widespread call of late for small channels, angles and the like for housing programmes.

NON-FERROUS METALS

Speaking in the debate on the Government's nationalisation policy in the House of Lords last week, Lord Geddes gave instances from his experience of the non-ferrous metal industries of the handling of copper buying by the Ministry of Supply. He said that there was a shortage of 400,000 tons of copper this year and that was quite a lot. That was the sort of thing which happened when one group of men tried to handle an enormous industry of which they had very little knowledge in detail. If the Government took charge of other commodities or industries on the lines on which they had taken charge of copper supplies, heaven help the country.

Lord Geddes' mention of a copper shortage has aroused considerable comment in metal circles and it has been recalled that Mr. Chester Beatty recently expressed fear of a surplus of the metal. The world copper has a large surplus capacity, although production has lately been restricted due to widespread strikes in the United States, a general shortage of labour at the mines, repairs and replacement of equipment, and the expectation of the leaders of the industry, until recently, that copper sales would be limited to heavy surplus pressure.

This country's copper requirements during the war were covered satisfactorily by Empire bulk-buying contracts, which were cancelled at the end of January, 1945, when stocks were sufficient to meet a full year's needs under active trading conditions. The Ministry of Supply has, since that time, endeavoured to rid itself of large stocks. Exports have been made from reserves, while last year's imports were cut to less than a third of the wartime average and only half the normal pre-war tonnage. The result has been that by the end of March last copper reserves were down to about 80,000 tons, or only just sufficient to keep manufacturing industries supplied. The Ministry has recently entered into new contracts in Rhodesia, Canada, the Belgian Congo and Chile.

It is understood that the scheme for provision of Government financial aid to Malayan tin producers to help in the rehabilitation of properties and equipment damaged during the Japanese occupation has received fairly general approval. Funds for this purpose are to be made available through the Malayan Government, with companies drawing on the Crown Agents for the Colonies for schemes approved by the Ministry of Supply. Interest is 3 per cent., but no interest is payable until 1950.

The discussions between the Nigerian tin producers and the Ministry of Supply for renewal of the bulk-purchase contract which expired last December are still proceeding. No reply has yet been made by the Government to the producers, following the latter's refusal to accept a new contract at the old price of £300 per ton, f.a.s. Nigeria, it is understood.

MR. C. R. WHEELER has relinquished his duties as Controller of Iron and Steel with the Ministry of Supply, and on rejoining Guest Keen Baldwins Iron & Steel Company, Limited, has been appointed joint managing director.

A DELEGATION from the Constructional Engineering [Trade] Union to the Board of Trade and Ministry of Supply protested against the export of steel sections, as the shortage of these was adversely affecting the engineering industries in which their members were engaged.